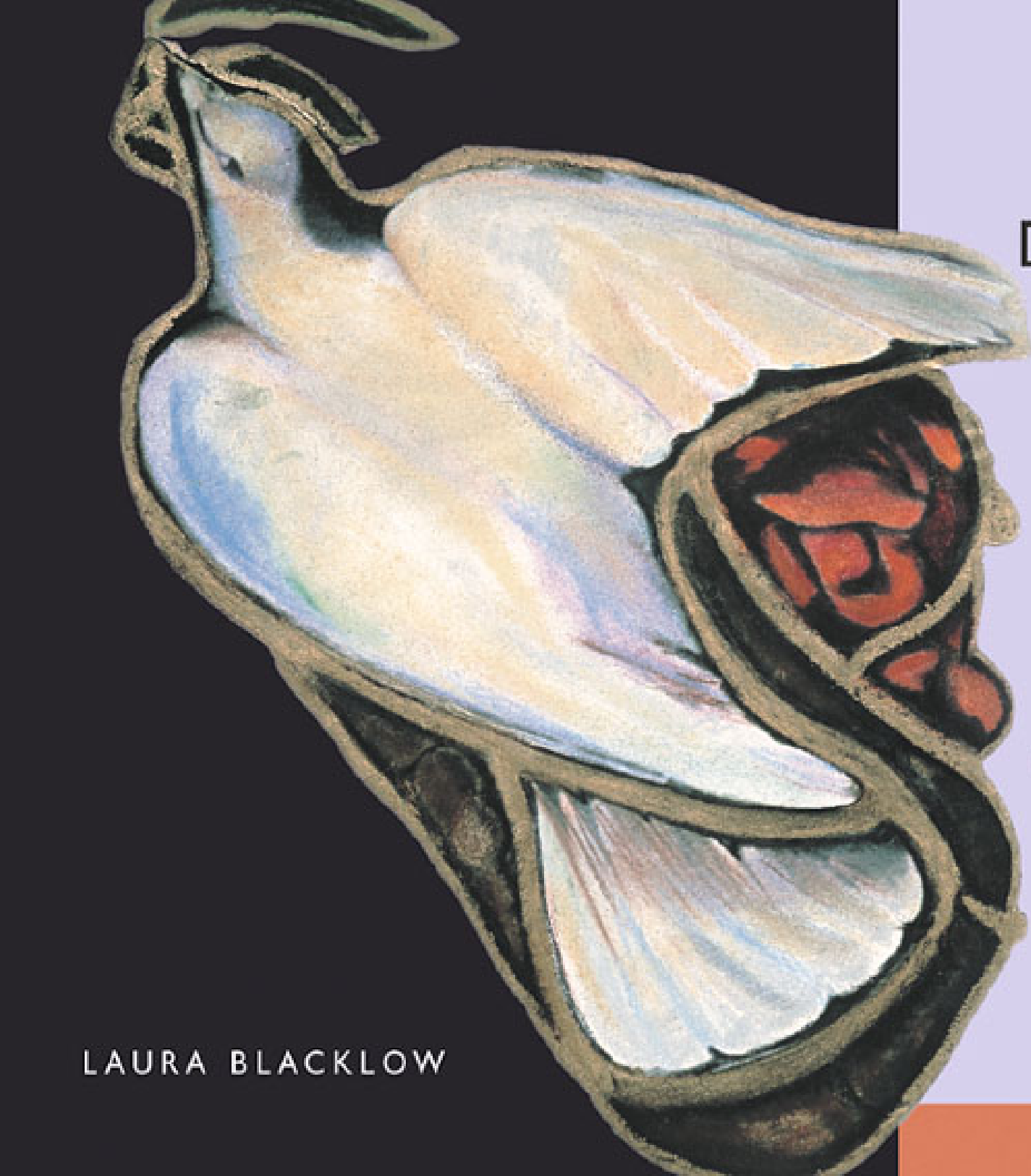


NEW DIMENSIONS IN PHOTO PROCESSES

A Step by Step Manual for Alternative Techniques

4TH EDITION

LAURA BLACKLOW

Focal Press

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New Dimensions in Photo Processes

A Step-by-Step Manual in Alternative Photography, Fourth Edition

Laura Blacklow

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Pinhole photographs by Walter Crump
Alternative Color images by Juliana Swatko
All drawings by Laura Blacklow

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Acknowledgments

The writing of this book was undertaken almost by accident. While I was freelancing as an illustrator, I showed my portfolio of photo images to Lista Duren, an editor at Curtin & London Publishing Company. Ms. Duren brought the portfolio to Dennis Curtin, who, on the spot, asked me to write a book about the techniques represented. Curtin & London subsequently ceased publishing photography books, and so Focal Press picked up the manuscript.

I wish to acknowledge the work of the staffs at Curtin & London and Focal Press, as well as the enormous contribution of Virginia Holmes, who helped research and write the first draft. Gene Laughter, who was recommended to me by Karl Koenig, wrote the thorough Bromoil Printing (Chapter 13) and was a delightful collaborator, even under pressure. I was fortunate that Gene could secure the photographic expertise of Wayne Firth, who took the step-by-step illustrations for that chapter. I appreciate being educated to chromoskedasic painting (in Chapter 15) by Birgit Blyth, who, fortunately, did not make up that word. Elaine O'Neil assisted in organizing and refining the manuscript and helped write the Toning chapter (Chapter 3). Her wonderful brown print quilt is reproduced in this book. The new chapters and sections were voluntarily written by artists of enormous talent: Juliana Swatko (Alternative Color Photography, Chapter 15), who offered the idea for her section; Jesseca Ferguson and Walter "Rusty" Crump ("Making Pinhole Negatives," in Chapter 5), who dug in without much help from me; the incomparable Youngsuk Suh, who worked hard not only writing about and making digital negatives but also testing each negative with the different techniques (Chapter 6); and Dorothy Imagire (Muscle Rub Transfers and Lazertran™ Inkjet Lifts in Chapter 1), who always is brimming with terrific ideas. Tyler Treadwell, a student at the School of the Boston Museum of Fine Arts, helped me untangle the web of the Daguerreotype (Becquerel) process, with tips from Jerry Spagnoli, Bob Shlaer, and Alyssa Salomon. Others provided useful information: Seymour Rottenberg, vice president of Kwik Proof; Robert Cone, manager of the Rockland Colloid Corporation; Bart DeVito retired from Luminos; Melody Bostick at Bostick & Sullivan; digital artist extraordinaire Carl Sesto; fabric artist Susan Podshadley; Robert Fairchild, electrician; Martyn Greenhalgh for providing me with information on U.K. suppliers; and Neil Gordon, president of E. J. Ardon's (until recently one of six graphic arts stores more than 50 years old in the United States). S.B.I. Sales in Boston, Massachusetts, loaned me photo materials; the E. Philip Levine Company (owner Steve Brettler is a most honest dealer of used equipment, too) of Boston loaned new photo equipment; and Agfa Corporation gave me photographs for the three previous editions of this book. Pictorico kindly gave me acetate, and Bill Schultz of William Paul & Associates donated graphic arts film to me and my students in Guatemala.

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Gratitude is due the artists whose artwork enlivens these pages. I would like to acknowledge the many students in my classes, whose ideas and enthusiasm added immeasurably to the book.

I dedicate this book to my husband, Peter Fougere, an inspired carpenter and musician, whose support and feedback have proved invaluable, and to my son, Noah Fougere, now a ceramic artist on his own right, who never put up too big a fight giving up the computer to accommodate his mother.

Introduction

New Dimensions in Photo Processes (Photo Imaging, in the first edition, pre-home computers) presents techniques that combine painterly concerns with printmaking ideas, photographic principles, and graphic design elements. Painters, for instance, think about the articulation of an image by the physical application of materials and by the selection of a surface onto which the materials will adhere. Printmakers are familiar with different types of paper and the variations that can be achieved in a print while creating an edition. Traditional photographers, used to the light sensitivity of certain substances, may think about the way a photographic technique can change the visual reading of a picture. Graphic designers and illustrators use special tools, procedures, and often text, developed for their profession or borrowed from others. I hope this book will speak to professional artists, teachers, students, and hobbyists who are comfortable employing technical methods and ideas from different image-making areas and will assist in the creation of more cogent visual statements.

Arising from a printmaking syntax,[1] photo imaging has always been affiliated with other art forms. William Henry Fox Talbot, in 1839, invented a process related to Van Dyke brown prints (see Chapter 8) partly out of frustration with his unsuccessful attempts at drawing. You see, in nineteenth-century British society, part of a gentleman's education was learning how to draw. His first book, illustrated with *photogenic drawings,* as he called his photographic prints, was titled *The PENCIL of Nature* (emphasis mine). The 1844 edition included Talbot's drawings, his early experiments with laying objects atop sensitized paper to produce photograms, and his pictures taken with a hand-built camera fitted with a microscope lens, which his wife is said to have called "mouse traps" (see illustration, pages 168 and 169). Talbot also wrote about the difference between visual reporting and visual expression—distinctions we still debate today.

Many methods described in this book were presented in the 1830s and 1840s. That period in Europe and England saw a proliferation of home inventors, spawned by the mass printing of illustrated books and magazines dealing with experiments in science and technology. Sir John Herschel, for example, developed the cyanotype technique (see Chapter 7) as a method for reproducing a small number of his mathematical charts. Soon after, architects and engineers adapted the process for blueprinting their drawings, and by the beginning of the twentieth century, photographers were using the procedure for

[1] Jussim, Estelle. *Visual Communication and the Graphic Arts: Photographic Technologies in the 19th Century.* New York: R. R. Bowker (a Xerox Education Co.), 1974.

printing black-and-white negatives. Herschel is also credited with coining the terms *photography, snapshot, negative,* and *positive*.[2]

The business world adapted other photo-printmaking processes. The principle for gum bichromate printing was—and is—the basis for photo silkscreen, photolithography, and commercial offset printing. The gum arabic used for gum printing in 1839 was replaced later by bichromated gelatin. A coating of the light-sensitive gelatin on metal was exposed under a negative in print shops by 1850. Exposure and development hardened the gelatin (the positive), which was used to attract lithographic ink in commercial printing. A hardened gum-and-color-pigment positive is the finished product in a gum print.

Industrialization brought the mass production of factory-made photographic papers, films, and cameras. In 1898, George Eastman marketed the Kodak camera loaded with film, which could be used and then sent back to the Kodak factory by the photographer. The film was developed, prints were made, and the camera was reloaded with film. Eastman's method freed photographers from chemical manipulation and technical knowledge. Cyanotypes, Van Dyke Brown, casein (see Chapter 10), and other hand-coated emulsions, therefore, lost favor with the public. These processes were not seen much until the 1960s and 1970s. Theories have been postulated about the reappearance of home-made photo techniques at a time when a significant segment of Western culture was revolting against the alienating aspects of technology. Now, I believe, all silver-based media, such as traditional black and white photography, will be regarded as "quaint," "historical," and "alternative" in the age of digital and electronic imaging.

I was additionally influenced by research into women's history, where handwork, especially on cloth, flourished. Most of these techniques can be printed on fabric as well as paper, and instructions for imaging on both surfaces is explained in this book. Artists such as Betty Hahn and Bea Nettles exploited the possibilities of stitching photo imagery, and their manipulated images influenced other artists.

These antique processes can make new statements, as you will see by viewing the color figures throughout the book. The picture maker does not need to have sophistication in chemistry, physics, or even photography. I have tried to write step-by-step directions that can be followed easily and without access to expensive equipment. It is hoped that the reader will enjoy learning these methods and that they will become second nature, so that the technical aspects are of little concern compared to the visual possibilities and the challenge from working creatively.

The title of this book has been changed from *New Dimension in Photo Imaging*, the name of the first edition (1988) and second edition (1995), to *New Dimensions in Photo Processes* because now "photo imaging" has come to mean digital imaging. Also the chapter on Kwik Print has been removed from the book because, in 2000, the product ceased to be manufactured. Kwik Print instructions, however, have been posted on the Focal Press website, www.focalpress.com/companions, where the curves for the digital negatives are, too.

[2] Gassan, Arnold. A *Chronology of Photography.* Athens, OH: Handbook Company, 1972, p. 23.

The book is divided into three parts. Part I presents methods that can be carried out in daylight and are therefore called *light-insensitive*. Part II should be read before trying any of the light-sensitive methods. Chapter 4, Creating the Photo-Printmaking Studio, contains information on sizing paper, registering negatives, and building equipment such as an ultraviolet exposure unit. Chapter 5, Making Negatives: Analogue Method, and Chapter 6, Making Negatives: Digital Method, include both photographic and nonphotographic techniques for making the image transparencies needed for contact printing. Part III consists of directions for nine light-sensitive processes. Some people refer to these methods as nonsilver photography, but the label is not entirely accurate. Silver nitrate is used in brown printing, for instance. The terms alternative and nontraditional photography are also used, because the hand-coated emulsions are seen more rarely than conventional black-and white or color photographs. Given the previously described history and contemporary practice of photo imaging, there is some irony in these terms. Several processes, such as traditional Daguerreotype, carbon printing, and photogravure, are not included because of their high cost or safety concerns. Books on these processes, however, are listed in the Annotated Bibliography.

The step-by-step procedures are separated from the rest of the text in order to allow you faster access to methods for each technique—*but always read the whole chapter before starting*. The Tips, for instance, will make your work sessions more enjoyable and productive. It is imperative that you pay attention to the Safety sections within each chapter so that you take care of your health as well as the physical condition of the environment. Supply Sources for needed equipment are listed in the back of the book. Please observe these symbols as you use this book:



Can work in **bright light**. You can turn on room lights, and sunlight can illuminate the room.



Work in **subdued light**. You can use weak tungsten light or draw the blinds in your work space during the day.



Work in **safelit conditions**. A safelight, available from a photography store, equipped with a Kodak safelight filter, number 1A (light red), a wratten OC (light amber) or equivalent, and a 15-watt bulb should be placed no closer than 4 ft (1.25 m) to the emulsion. To make sure the safelight is not so bright as to cause fogging, thereby exposing the emulsion accidentally, run a fog test. On your work surface, put a piece of ortho film (Chapter 5) or paper coated with liquid emulsion (Chapter 13) and dried. Place two coins, side by side, on top and leave them there for 3–5 minutes, or a time equivalent to how long it takes you to prepare a substrate. Then remove one coin and carefully position the sheet with the other coin under your enlarger. Shine a minimum of light, such as one second at f/16, on the sheet. Eliminate the second coin and develop the sheet. See if where the coins were remains clear (with duplicating film, it will be a black circle). If you see a silhouette where the coins were, move your light further away or replace the bulb with one of weaker illumination.



Wear **protective gloves**. For these processes and for cleaning up, heavy chemically-resistant gloves such as neoprene are recommended. You can find them in a hardware store. Playtex now makes HandSaver gloves with latex and Neoprene, which can be purchased at a grocery store. After a work session, wash the gloves and inspect them; if they appear damaged, replace them. Wash the inside and outside of the gloves with a slightly acidic hand cleaner such as pHisoderm™, then hang them inside out to dry. If the gloves are not cleaned properly, they can actually increase your exposure to dangerous chemicals—dirty gloves promote the absorption of contaminants through the skin. Wash your hands before leaving your workspace, even if you wore gloves.



Wear a **ventilating mask**. Please talk to your doctor before using a respirator. If you can use one, make sure a knowledgeable person fits you. You will need a rubber half-mask air-purifying respirator with a filter for organic vapors and dusts and mists. You can choose between reusable or disposable respirators, but make sure that in the United States you purchase one approved by OSHA. You can purchase masks at automotive paint and body shops or good hardware and art stores. If you need help in selecting the right kind of respirator, consult insurance companies, the National Institute of Occupational Safety Hazards and Occupational Safety Hazard Administration personnel in the United States and the Workplace Hazardous Materials Information Systems in Canada, respirator manufacturers and distributors, or the Arts, Crafts, and Theater Safety (see Annotated Bibliography, pages 279–287). Keep in mind that respirators cannot be used if anything interferes with the seal of the face piece against an individual's face, such as sideburns, beards, and eyeglasses. Store respirators in clean bags or other suitable containers in a clean and sanitary location. Inspect and maintain the respirator in accordance with the manufacturer's instructions. Pregnant women should not attempt any processes requiring a respirator because the mother's oxygen intake may be reduced, limiting the oxygen available to the fetus. If you have other health issues, such as heart problems, make sure you consult your doctor before using a respirator. One test for checking the fit of your respirator is to put it on, open a bottle of ammonia, then make sure you cannot smell the odor.



Wear **ultraviolet screening goggles** to avoid splashes, protect your eyes from dangerous light rays, and always wear goggles if you use contact lenses.

Don't just take my word for it; when ordering chemicals, ask for the Material Safety Data Sheet, which gives specific information on handling and storing each chemical in order to reduce your exposure, as well as first aid and protective equipment to wear.

Good health habits in the studio and darkroom are lifesavers. Never eat, drink, or smoke while handling chemicals. Keep your hands away from your face. Wear a special lab coat or waterproof apron while working, not your unprotected clothes. Avoid splashing chemicals; if you think a procedure will cause splashing, wear goggles to protect your eyes. (When in doubt, put on goggles—and mask—especially if you wear contact lenses.) Clean up spills immediately, preferably with paper towels. Throw paper towels and other refuse into a covered trash can or into a plastic bag. Seal the

container and move it to an outdoor receptacle after your work session. Avoid mixing liquid and solid wastes.

Try to limit your chemical mixing and coating to one table with a nonporous top, such as glass. I cover my table with the Sunday newspaper unfolded. Each time chemicals contaminate the top sheet of paper, I throw it into a plastic trash bag, which I secure with a tie. I learned from the former Palladio Co., that you can "evaporate used liquid chemicals and dispose of the sludge as toxic waste," but don't evaporate in your small darkroom. I also learned from *The New Photography* (see Reeve and Sward in the Annotated Bibliography) that hazardous liquid chemicals, such as unused cyanotype mixtures, should be absorbed by kitty litter, put in a plastic bag, and placed in the trash outside the building. I actually bring it to the city on toxic waste day. The volume, once evaporated will be small. Most towns have one or two days set aside for collection of such labeled materials. Fixer, used to enlarge negatives and stabilize brown prints, is toxic to marine life. Contact a university or commercial darkroom and ask if you can pour your used fixer through their silver recovery unit. Otherwise, flush chemicals down the drain with large amounts of water after reversing the order, such as exhausted fixer poured into used stop and both poured into "dead" developer in order to neutralize them first. Judy Seigel recommends cutting the narrow part of the spout off a large funnel (auto supply store) and inserting the spout into your drain to contain the flow during disposal of chemicals. My own darkroom has special pipes with limestone linings.

Keep all chemicals out of the reach of children and pets, and preferably in a locked cabinet away from heat and electric or other sparks. Most fire departments want to know the type and location of chemicals stored in your work space.

Ventilation is necessary in the darkroom and the studio; an open window is not proper ventilation! Kodak recommends 10 room air changes per hour, but the Center for Occupational Hazards urges that a small work area change air at least 20 times per hour. To determine the size exhaust fan required to change the air, compute the size of the room (in cubic feet) by multiplying the length by width by height, then divide that figure by six. Match that number to the fan's cfm rating.

Locate the exhaust fan so the vapors are pulled away from your face. Hence, the suggestion that you limit your chemical mixing and coating to one table becomes even more important. Because most vapors that result from photographic processes are heavier than air, it makes sense to install a vent near the floor or right where the vapors are released. Fresh air must enter the room in order for the ventilator to work properly. Cracks under the door or light-blocking vents (for a darkroom) are the solution.

If your workspace is also a living space, such as a bathroom, you need to be meticulous about your habits. Never use eating, storage, cleaning, or cooking utensils for making art, or vice versa. Separate chemically-contaminated trash from household trash. If you must use your kitchen, limit your work to one area where you do not prepare or eat food.

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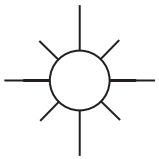
Part I

Light-Insensitive Methods

1 Transfers and Lifts 2

2 Hand Coloring 32

3 Toning 48



Daylight



Subdued Light



Safelight



Protective Gloves



Respirator



Protective Goggles



© Robert Rauschenberg, *Mainspring,* 32 × 62½ in. frottage on paper, 1965 Collection of Mr. and Mrs. Donald B. Marron.
Photo credit: F. J. Thomas Photography.

Rauschenberg incorporated solvent transfers into his artwork after he discovered that rubbings could be made from newsprints wet with lighter fluid. These drawings retain a gestural appearance from the back-and-forth movement of the rubbing implement. The transfer process offered a wide range of subject matter to Rauschenberg, one of the great living artists with a long history of art-making, I think, because of his enthusiasm for experimentation and ability to communicate vital issues articulately.

Chapter 1

Transfers and Lifts

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Solvent Transfers

A fast and simple technique, *transferring* allows you to remove the image from a magazine, newspaper, or photocopy and relocate it on various surfaces such as paper, fabric, frosted acetate, drafting vellum, or lithographic stones or plates. Solvent and pressure combined dislodge the ink from the page and allow the image, without the original paper, to adhere to the receiving surface. Reproductions of photographs or drawings in black-and-white or color can be transferred. You can write or draw onto a transferred image or onto the receiving surface before or after transferring; you can sew into them, mix media processes with transfers, or locate one image on top of another. Because the inks are oil-based and not soluble in water, transfers on cloth remain permanent when washed in mild soaps.

Contemporary artist Robert Rauschenberg, whose "mainspring" opens this chapter and whose work can be seen in major museums, has combined transfers with other mediums in his wall-mounted panel installations, lithographs, paintings on satin and silk, and drawings on paper. Rauschenberg's series, *Dante's Inferno*, exploits the gradations of tone achieved by changes in pressure from a ballpoint pen when making the transfer. Later, Rauschenberg sprayed a fine solvent mist on smooth and crumpled printed images, which he sent through a lithograph press with natural fabrics underneath for his *Hoarfrost* series.

Safety

Be sure to work in a well-ventilated area, a place that has not just an open window, but 20 air changes per hour. All the solvents used in this process are highly flammable and noxious to breathe, irritating the eyes and respiratory passages, and have a narcotic effect on the nervous system. They also dry the skin and can cause serious damage to the kidneys and liver. If you use citrus solvent, do not be fooled by the label "natural"; rather, avoid contact with eyes and prolonged or repeated contact with skin. Read all warning labels and wear *neoprene* gloves when handling solvents. Wear an organic solvent vapor mask when working in close proximity with solvents.

Immediately replace the cap or covering on solvent containers after use, and discard paper or other materials in a manner that prevents further release of the solvents into the air you are breathing. Do not store solvents in inappropriate containers after use (e.g., solvent eats through Styrofoam™); use metal or glass containers. Isolate solvents from heat sparks, electrical equipment, oxidants, and open flames. Fumes tend to cling to the transfer after it is made, so air it out in a well-ventilated area away from your living space until the solvents have evaporated.

Method Overview

1. Printed page to be transferred is removed from its source and prepared.
2. Solvent is applied to the back of the page.
3. Transfer of the image from the page is made by rubbing the back of the image, forcing the ink off the front onto the receiver.

Materials

1. Image. A *photocopy*, *magazine page*, or *newspaper page* will work well. Most magazines are printed on coated stock (clay-impregnated slick paper), which is very effective for transfers because the ink rests on the clay (kaolin), not on the paper. Make sure that the image to be transferred is not gravure-printed or varnished (as are magazine covers, generally). The newer the publication, the fresher the ink and the easier the transfer will be. The thinner the paper, such as newspaper, the less solvent and pressure needed for transfer. Because you cannot transfer the same image material clearly more than once, copies of the same newspaper or magazine issue or photocopies of your own pictures offer an inexpensive source for multiple transfers. Expensive magazines tend to use finer reproduction methods, resulting in more detailed transfers. Even printed wallpapers can be

used. I have started with a black-and-white photograph, which I put on a color copier and reproduced in any or all of the colors available on the copier, but you can also make copies and scans from color slides and flat art. The copier's and digital printer's color balance and zoom functions add to your aesthetic choices, and you will find that some copiers accommodate sheet sizes up to 11 × 14 in. (28 × 35.5 cm) or larger. Another way to create large images is to combine several small transfers into one larger image.

2. Metal spoon or etching or lithography press.

3. Solvent. Only silkscreen supply stores carry transparent base, and the only brand I know of still available is Naz-Dar Trans. Base number 5530. Use it on the *back* of the images. Pantone and Admarker, to name two companies, make blender pens for their permanent ink felt-tip markers. (A more detailed description of how to use these pens appears in the Tips section.) Oil of wintergreen or oil of lavender, fabric spot remover (such as Carbona™), lighter fluid, lacquer thinner, and offset blanket wash can be applied, but these are more difficult to work with because they evaporate more quickly. Apply these solvents to the *front* of the picture.

4. White scrap paper. The paper should be larger than the size of the transfer image. Inexpensive bond paper is excellent.

5. Black permanent marker.

6. Scissors or stencil knife.

7. Tissues or paper towels.

8. Masking tape or drafting tape. Drafting tape is less sticky than masking tape and will not rip artwork when removed. To make masking tape less sticky, press the tape first onto your clothing before using it.

9. Hard, smooth work surface. Imperfections in your table or desk will show in the transfer.

10. Plastic bags. For solvent trash, to prevent continued release of solvent vapors into the air you breathe, wrap up and dispose of used materials.

11. Light table or window with daylight. To draw an outline of where to apply the transparent base on the back of the page, you need to hold the image up to a light and to be able to see through from the front to the back. A home-made light table is described on page 63.

12. Receiver. Almost any paper or fabric will work, although material with bumpy surfaces like traditional watercolor paper or corduroy fabric proves difficult. Fabric should be stretched in an embroidery hoop or stapled to chip board or some other smooth surface. You can make transfers onto wood.

13. Vapor mask and gloves. All solvents are dangerous, so a respirator and gloves should be worn.

Tips

■ The transferred image will appear the reverse of the original; this is an especially important consideration when transferring type. You can solve this problem by photocopying the art onto acetate, flopping the acetate, and making a wrong-reading photocopy on paper. When the wrong-reading

image is transferred, it will look like the original art. With a scanned image, you can choose "mirror image" or "flip horizontal" in printer choices.

■ Since you are lifting the color layers from color printed material in the opposite order in which they were printed, colors may appear different in the transferred image. In general, select color pictures with bright highlights and deep shadows so the transfer retains separation of tones. Low-contrast images can be frustrating to transfer with clarity.

■ The blender pen, which seems to keep odors down, can be used if you transfer small (2 in. or 5 cm square) areas at a time. Rub the marker on the back of the image, then quickly burnish. This method works best with color laser copies and computer laser prints, especially if you first copy the image onto acetate, rather than paper.

■ Transparencies can be made by transferring onto the dull side of frosted acetate or drafting vellum.

■ Older magazines or other publications may need more time and more transparent base for the solvent to penetrate and loosen the embedded ink.

■ Crayola™ makes fabric crayons for iron-on transfers to synthetic fabrics from nonglossy drawings on paper.

■ You can transfer onto a lithographic stone or plate. Use an acetic acid etch and print normally. Since images transfer in reverse, type will, in the end, print correctly for reading.

■ If you are using an etching or lithographic press, place the paper or cloth being used as the receiver *face up* on the bed of the press, and place the image *face down* over the paper or cloth. Apply the transparent base to the back of the image area and let it set a few minutes. Wipe off excess transparent base after it has absorbed into the paper—paper will be more transparent so that you can see through to the print on the other side. Place blotter paper on the back of the image to protect the felts of the press from the solvents, and run the complete setup with the felts through the press using the correct maximum pressure. To make transfers onto cloth, mist the front of the magazine image with spot remover (such as Carbona™) or the back with citrus solvent; you must work quickly because the spot remover evaporates.

■ After you transfer an image, let it air out in a well-ventilated area away from the space where you are working.

■ The Magic Touch and Wm. Paul and Associates (both are listed in Supply Sources) sell 8½ × 11 in. (size A4 in Europe) and 11 × 17 in. (size A3 in Europe) transfer sheets that work in color or black-and-white copiers and laser printers to duplicate your image for heat transferring onto fabric, wood, metal, glass, or ceramic.

■ For obtaining more detail on cloth, spray fabric first with spray starch before transferring.





Peter Madden, *Vestiges: A Three Decade Inventory,* approximately 7 × 3 ft., solvent transfer on brown paper bags, waxed, sewn, 1990.

Madden created this larger-than-life piece when he turned 30 years old. It catalogs every mark on his body that he was not born with—scars from accidents, falls, stitches, vaccine marks, tattoo, pierced ear, broken nose, hernia, etc. First, Madden used the large-format 20 × 24 in. Polaroid camera to make three life-size color self-portraits. Next, he went to a copy center and had these pictures reproduced via a large copier usually used by architects to replicate their drawings. Lastly, he transferred these huge black-and-white copies with silkscreen transparent base onto numerous paper bags, which he sewed together with his words.

Making a Solvent Transfer



1



Preparing the image

Cut out the magazine picture or other image at least ¼ in. (6.5 mm) larger than the image all around. Working at your light table or against a daylight window with the image facing away from you, use the black ink marker to draw the outline of the area you want transferred onto the back side of the image.



2



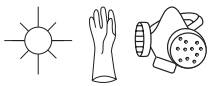
Making and attaching the cutout frame

Place the large piece of scrap paper on the back side of the image and retrace on it the image shape marked in step 1 using the light table or window to aid in the tracing. Cut out the shape marked on the scrap paper to create the cutout frame.

Place the image face up on your work surface. Adhere the masking or drafting tape onto the corners of the image's back side, with the sticky side of the tape facing you and the tape extending beyond the edge of the paper. Place the cutout frame over the image so that the frame lines up with the image, pressing the cutout frame to the tape. This frame, later, will prevent solvent from staining your receiver. If you adhere the tape on one edge of the frame, you can use it as a hinge for checking on the progress of the transfer while you work.

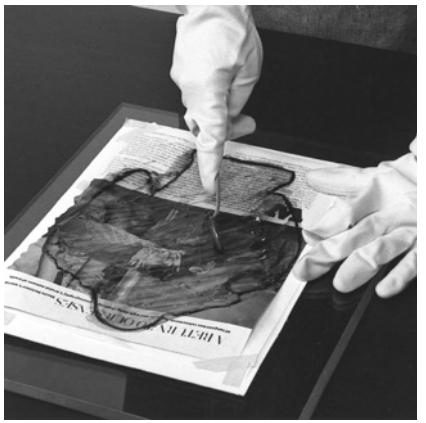


3



Applying the solvent

Place the receiver surface face up. Position the cutout frame and image face down, and tape this unit to the receiver. Apply to the *back* of the image approximately ½ teaspoon (2.5 ml) transparent base for a 5 × 7 in. (12.5 × 17.75 cm) image. Spread evenly and let the transparent base sit for a few minutes while it absorbs into the page to chemically loosen the ink. The paper will appear less opaque.



4



Transferring the image

Using the *edge* of the spoon, vigorously rub the back of the paper within the cutout frame window. To achieve a smooth transfer, rub in small circular strokes. To achieve a more drawing like appearance, rub back and forth. Pick up one corner and check the transfer periodically, until the image has transferred completely to the receiver material.

Tips



©Kathy Halamka, *Reconstruction*, 4 × 2 feet charcoal and mixed media on birch with heat transfer, 2004.

Method

■ A simple, easy, nontoxic method for transferring ink jet prints is to print the image onto acetate, because the ink lays on the surface. Brush the *receiver* with a liberal coating of gel or polymer medium. Before the medium can dry, quickly place the acetate, ink down, onto the medium. Do not let it move around as you rub the back with a brayer, spoon, or bookbinder's bone folder. Remove the acetate.

■ Some of my students have merely dampened the surface of hot press (smooth artist's) paper and laid the ink jet print on acetate face down on the moist surface, thoroughly burnished the back without moving the acetate, and lifted off the acetate. The ink should be on the receiver, and the acetate should be fairly clear.

■ Computer and stationary stores sell transparent stickers that you can run through ink jet printers. If you want more ideas for digital transfer methods I recommend *Digital Art Studio* (see Bibliography), a book full of thoroughly researched and clearly explained techniques.

Heat Transfers

(Described to the author by Kathy Halamka)

Materials

1. Heating tool. Options include the Lenk Heat Transfer tool or Versatool by Walnut Hollow, each of which has a handle similar to a wood burning tool but comes with a flat, round disk for the heatable head; photography tacking iron; or old-fashioned travel iron without steam holes.

2. Hard, firm, heat-resistant work surface.

3. Spray bottle or bowl of water to control scorching or accidental misapplication of the heat tool on the fingertips.

4. Receiver. You can use smooth paper, wood, or finely woven fabric.

5. Image. Toner copies, such photocopies from an office copier.

6. Low-tack tape.

1. Pre-warm your transfer tool for at least 10 minutes. Sufficient heat is important for success, since dry toner's melting point is 212–248°F (100–120°C).
2. Place the photocopy image-side down onto the receiver. Lightly secure the edges with low-tack tape to make sure the image stays in position.
3. Apply the heat tool flat to the back of the copy. Press firmly over the back of the copy in a regular circular motion. Gently lift up one corner of the photocopy paper to see if the toner has transferred.
4. Lift off the photocopy when you have transferred the amount of an image you wish. Lightly reheating the receiver will help you remove any stubborn paper.

Muscle Rub Transfers, by Dorothy Imagire

Similar to solvent transfers, but without the toxicity, the "solvent" is in the thick muscle rub base. The dissolving and evaporating process is slow, allowing you to work on a larger area; however, since the base is thicker and slower than many traditional solvents, it needs to be applied to the front of the image to be transferred.

Safety

The most important warning is on the tube of muscle rub: avoid contact with the eyes, open wounds, or irritated skin. Do not ingest. Wear gloves to avoid prolonged contact and wear goggles to avoid contact with your eyes.

Methyl salicylate, an ingredient in some muscle rubs, is a toxic extract of wintergreen that has killed children when swallowed in concentrated doses.



Dorothy Imagire, *On a Bed of Rice*, **4 × 11 × 7, wood, silk, rice, copy transfers on rice paper, 1998.**
www.imagire.org

Method Overview

1. Printed page to be transferred is removed from its source and prepared.
2. Muscle rub is applied to the front of the page.
3. Transfer of the image from the page is made by rubbing the back of the image, forcing the ink off the front onto the receiver.

Materials

1. Image. Same as solvent transfers. The image needs to be reversed to end up correct reading.
2. Rubber brayer, metal spoon, or etching press.
3. Muscle rub. Available at a pharmacy, Bengay is the brand name, however any generic version of Bengay can be used. The generic brands seem to contain more water and are looser, but the quality is of no disadvantage because you will be trying to spread it anyway. The aroma does seem to linger, so airing out the print is helpful. (The book's author notes that she finds the tube form of muscle rub is the only one that works and particularly recommends CareOne ultra-strength cream.)
4. Brush. A soft 1½ in. (3.75 cm) goat hair Asian brush, or any other soft brush. Inexpensive brushes can be purchased at a hardware store.
5. White scrap paper.
6. Scissors or stencil knife.
7. Tissues or paper towels.
8. Low tack tape. White artist's tape or blue painter's tape.
9. Hard, smooth work surface.
10. Receiver. Same as solvent transfer.
11. Goggles and gloves. These items are important in order to avoid contact with eyes, open wounds, and prolonged exposure to skin.

Tips

- This process is similar to solvent transfer, except that blender pens, film cleaner, or movie cleaner do not work in conjunction with the muscle rub.
- I have successfully used a printing press, rolling the image through once. If you have one available, use it. Place your receiving paper on the bed first. Then coat the front of the transfer image with muscle rub and place it face down on the receiving paper. Put on felts and roll the image unit through the press.
- You can create muscle rub transfers on fabric as well. The higher the thread count of the cloth, the more detail will be visible in the resultant image. Natural fibers such as cotton, silk, and linen absorb the ink better.

Making Muscle Rub Transfers



1



Preparing the image

You do not have to cut out the image unless there is a background that you do not want to include. If it is a digital image, make sure it is flipped horizontally, or if it is a copy, have the copy reversed. Any image on nonglossy paper seems to work. In addition, you can use inside pages from magazines and newspapers.



2



Making and attaching the image

With artist's or blue painter's tape, adhere the corners of the receiving paper so it does not move. Position the transfer image face down on the receiving paper where you want the image. Tape across the top edge of the transfer image onto the receiving paper with the same tape (don't press too hard or it will be difficult to remove later). The transfer image should be able to freely swing up.



3

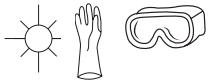


Applying the muscle rub

Lift the transfer image up and crease the tape so the image lies flat. Now the image side is up, although upside down. Place a piece of clean white scrap paper under the transfer image to protect the receiving paper and work space. With a 1½ in. soft brush, apply a medium coat of muscle rub over the transfer image. Brush left to right, then up and down, making sure there are no visible brush strokes. Muscle rub does not work as quickly as solvent, giving you a bit more time to brush carefully. Be very cautious not to rub your eyes with muscle rub–coated hands because it will sting!



4



Transferring the image

Put the transfer image down into position on the receiving paper. Working from the top, smooth down the image with your gloved hands. Using a rubber brayer, roll down, then up, then side to side to smooth out the image and, at the same time, press it firmly onto the receiver. The paper should begin to become transparent. If the muscle rub does not appear to soak into the transfer image paper, brush more muscle rub onto the *back* of the image (the side that is now facing you). Use the rubber roller lightly to help spread the muscle rub and with firm pressure to transfer the image. You can peek under a corner to see how the image is transferring. Once the image has completely relocated, carefully remove the used picture and tape.

Polaroid Image Transfers



Rick Hock, *Codex*, 22 × 30 in. Polacolor transfer, 1989.

Rick Hock uses text and images from the mass media and from fine arts. He copies comic book images, book reproductions, and other cultural artifacts onto black-and-white slide film. By inserting color filters into a Polaroid print processor, he selects the hues while he enlarges onto an 8 × 10 in. (20.25 × 25.5 cm) sheet of Polaroid film. He then uses a spoon to rub the matrix image onto paper. Relishing the disadvantage of not being able to exactly repeat something and the uncertainty of his results, Hock grids the images so that their new context changes the viewer's understanding of hackneyed or stereotyped subject matter.

Starting with a slide or taking a "live" picture, Polaroid Polacolor™ color films can be used to quickly and simply create full-color photographic images directly onto artists' paper and fabric. By prematurely interrupting the instant developing process, you can force the color dyes to migrate onto your chosen substrate. You can also write or draw on the receiving surface before or after the transfer process and position one image on top of another.

This procedure only works with the peel-apart Polaroid color films, not with instant films used with the 600 series One Step, Impulse, Cool Cam, and related cameras; the Time Zero film used with the SX-70 and Spectra cameras, nor black-and-white Polaroid films.

Rick Hock has exhibited multiple transfer prints internationally. Many commercial photographers also use this process. Legend has it, from someone who was there, that the technique was discovered quite by accident. That is, in the beginning of the Polaroid Corporation, its philanthropic founder and inventor Dr. Land and his assistant were demonstrating the then-new peel-apart color film. They pulled the film out of the camera back and waited for it to develop, but for a little less time than was required. After the film was peeled apart, one of them put the negative aside, face down on a Formica tabletop. After all, the objective was to sell the instant color positive. Following the demonstration, when they were cleaning up, the two men picked up the negative, only to discover the positive print on the Formica!

Safety

Read warning labels and wear protective gloves with all peel-apart Polaroid materials.

A sac containing an alkaline processing gel is discharged when the film is pulled through the film holder or camera rollers. This gel, appearing along the edges of the film and in the discarded portion, is harmful to skin, eyes, and mucous membranes. In case of contact, wipe it off immediately and quickly wash the skin with lots of water. Ingestion injures the mouth and esophagus and can be fatal. Inhalation of gel dust after it has dried can cause lung problems. Be careful not to discard trash where children or pets can reach it.

Do not discard processing gel waste in the vicinity of acids.

The color photographic dyes found on the negative before and after the image is transferred are suspected carcinogens, so it is especially important to observe safety standards as noted earlier.

Upon request, Polaroid will send you a copy of "Polaroid and the Environment," a brochure on postconsumer waste initiatives.

Method Overview

1. A receptor sheet is prepared.
2. A "live" situation is photographed or a projected slide is copied onto Polaroid peel-apart color film. A new mechanism, seen on Polaroid's website, also allows you to copy flat art and shallow three-dimensional objects onto Polaroid film.
3. The film starts processing by being pulled through a film holder or the rollers of a special Polaroid camera.
4. The processing is interrupted and the *negative* is placed on the receptor and rubbed.
5. The negative is removed, revealing the photo image positive on the receptor.

Materials

1. Polaroid equipment. Several approaches to creating a Polaroid transfer exist. You can start with a slide and use a Polaroid Daylab or used Vivitar Instant Slide printer, each of which is about the same price as a small 35 mm camera. The Daylab 35 also provides a 3¼ × 4¼ in. (8.25 × 10.75 cm) image, and the Daylab 35 Plus and Daylab II Pro can be fitted with the 3¼ × 4¼ in. base, an optional 4 × 5 in. (10 × 12.25 cm) base, an 8 × 10 in. (20.25 × 25.5 cm) base, and one for Time Zero and SX-70 instant film. I recommend the Daylab systems if you are starting with slides, and I recommend the use of Kodachrome for more saturated slides. Daylabs offer built-in color filters and cropping and enlarging features and can be used in regular daylight. The "Tips" section explains ways to use color filters effectively.

The Polaroid Daylab Copy System takes original flat art and objects up to 4 × 6 in. (10 × 15 cm) and copies then onto 3¼ × 4¼ in. Polaroid film. On eBay, you can find the old Polaroid Bravos, which work similarly to the Daylab Copy system, but accommodate up to 8 × 10 in. originals. Another choice is to project a slide or larger positive transparency (such as a "chrome" or an office copy or drawing on acetate) in complete darkness via a color enlarger or used (they are out of production) Polaprinter onto 8 × 10 in. (20.25 × 25.5 cm) Polaroid peel-apart film and run that sheet through a Polaroid 8 × 10 processor in room light.

You can also shoot "live" imagery, such as a still-life, portrait, or landscape. Use a large-format camera outfitted with a Polaroid back to yield 4 × 5 in. (10 × 12.5 cm) or 8 × 10 in. (20.5 × 25.5 cm) images, depending on the camera. A 2¼ in. (5.75 cm) or 35 mm camera outfitted with a Pro Back or N.P.C. back designed by legendary inventor Marty Forscher, available at good used camera stores and via www.mir.com, creates either one 2¼ in. picture or two pictures the size of a 35 mm positive (24 × 36 cm) on a sheet of Polaroid 3¼ × 4¼ in. (8.25 × 10.25 cm) film. I understand that this system was used by artist Cindy Sherman to test lighting and props for her directorial mode[1] pictures. Polaroid film backs for medium-format cameras are available through Calumet (see Supply Sources) in the United States and Europe.

Alternately, you can use an old Polaroid handheld Land camera (sometimes found at yard sales and flea markets and on eBay), the more expensive and difficult-to-find used 100 series Polaroid cameras, or the even more expensive Polaroid ProPack and 600SE (special edition) cameras.

[1] *Directorial mode* is a term coined by A. D. Coleman in his still-interesting book of essays, *Light Readings,* Albuquerque: University of New Mexico Press, 2nd rev. ed., 1998. Respected critic Lucy Soutter used the term *narrative photography* in the 1990s. Both writers are describing photographs in which the pictures look "taken" but are actually set up and "made."

Since colors shift and can be lost during the transfer process, you may try underexposing slides and live imagery by one-half to a full stop to achieve richer color saturation. Contrast increases with every generation of an image, and this is true with copying slides onto Polaroid film. One way to counter the problem is to use a low-contrast filter on your camera when you shoot the slide. In addition, dark areas can be tricky, so you may want at first to stay away from images with mostly shadows.

2. Polaroid peel-apart color film. You must use only Polaroid materials and only Polaroid Polacolor peel-apart films, not black-and-white or other color films. For a 3¼ × 4¼ in. image, use type 669 or 690. Each film has its own qualities, so if you prefer a softer look with pastel-like colors, try type 669, and if you want a more a more saturated look with punchier colors, try type 690. For a 4 × 5 in. format, use type 59 or 559, and for 8 × 10 in. pictures, use type 809. Polacolor 100 film has greater color saturation than the aforementioned films, but it has a yellowish tint that can only be corrected by using a blue filter on the slide printer and is far more temperamental. In addition, Polacolor 100 requires that the paper or other substrate be soaked in extremely hot acidic water (approximately one-half cup of household white vinegar to one inch water) if you use a 9 × 12 in. (22.75 × 30.5 cm) tray. Film should be at room temperature when you use it, but storing it in a refrigerator can prolong its life.

Polaroid packages two levels of image transfer kits: one includes 16 sheets of 5 × 7 in. (12.5 × 17.75 cm) watercolor paper, a 6 in. brayer, and a 9 × 12 in. (22.75 × 30.75 cm) tray; and a more expensive kit that includes two heavy-duty trays, three sheets of 11 × 14 in. hot-pressed watercolor paper, six watercolor notecards with envelopes, a timer, soft brayer, thermometer, tongs, step-by-step instructions, a Myler worksheet, and contact paper. The last two items are for Polaroid lifts, which are described later in this chapter. You can purchase either kit through Polaroid or Calumet in the United States and Europe. Both are listed in Supply Sources.

3. Receiver. Transfers will work on almost any paper, depending on your technique. For instance, transfers can be made without presoaking the paper, which may be more difficult but allows you to use any type of paper, from thin napkins to foil board. If you use the presoak method described in this chapter, you will need a paper that does not easily delaminate, such as printmaking paper. Arches makes a heavy 140 lb. watercolor paper, which Polaroid also packages in its transfer kits. Other papers that work well are Aquarelle watercolor (bright white), Curtis Paper Company's Tuscan Terra (lightweight, fibrous, and smooth), seamless studio backdrop (part rag content and available in multifoot rolls of various colors), frosted acetate, drafting vellum (wiped down with alcohol to make the colors adhere better), rice paper (softens and textures the image), and even wood veneer. Remember that smoother surfaces, such as hot-press paper, will retain more detail, while cold-press papers will create a rougher or more textured look. If the surface is too slick, the transfer might not take. Transfers can be made onto unglazed ceramics and fabrics, such as silk, where closer weaves retain more detail than, for instance, cotton. Polyester and acrylic fabrics tend to repel a Polaroid image. With both paper and fabric, dark-colored surfaces are inclined to cover the image, so light colors are preferable. See the section in Chapter 4 on supports for more details.

4. Water and tray. Transfers are best with a water pH of seven or higher (slightly alkaline). If you question the quality of your tap water, you can use distilled water. You need to fill a tray slightly

larger than your paper with enough water to totally immerse the sheet for several minutes. The water should be hot (95–100°F or 35–37.8°C) to promote adhesion of the dyes to the receptor. Or, try a *portable steamer* to moisten the receptor sheet evenly.

Some photographers use Knox™ gelatin in the water (see sizing recipe, page Ch. 4-80) with a few drops of film-wetting agent (such as Kodak's Photo Flo, diluted as the manufacturer recommends) in this water soak for more intense blacks in the finished transfer. I use a capful of white vinegar with 32 oz. (.95 L) water when I soak the paper, as this bath seems to intensify the colors.

For brighter colors with less yellow tone in the finished print, other photographers immerse the completed transfer in a tray of 1 part distilled white vinegar to at least 4 parts water for 30 seconds to 1 minute, then rinse in fresh running water for 2–5 minutes. Dilute the vinegar in more water if you have a problem with the image bubbling.

5. Squeegee and board. Use either a clean darkroom squeegee, windshield wiper, blotter, or paper towel to remove excess water from the receptor sheet. I have found that a reliably smooth surface, such as a piece of clean Plexiglas™ or Formica™ under the paper is helpful because it allows you to pick up the paper and drain the excess water into a tray or sink. With this method you are also unlikely to rip the paper while you squeegee, and the paper is temporarily laminated to the Plexiglas™, allowing more control while you make the transfer. If you are going to make a dry transfer, you will not need these two items.

6. Brayer (optional). To rub the negative evenly, some people use a soft rubber brayer such as the type found at art stores for linoleum printing. Others use a wad of paper towels, soft cloth, or a marble rolling pin from a kitchen supply store. (I use the side of my hand.) A plastic spoon helps transfer small, black image areas. Some of my students use a hair dryer or hot plate on the back of the Polaroid material, not the paper receiver, after they have rubbed it, then they press some more. Heat helps promote the dye transfer, especially in dark areas, which can lift off as a gummy layer and leave a blue tint on the paper.

7. Scissors and pencil. Due to the chemicals contained in the film, it is safer to cut rather than tear the negative from the Polaroid positive because cutting is less messy. I use a pencil to lightly mark where I want to place the image on the receiver.

8. Protective gloves. The process can be messy and the chemicals caustic, so use gloves. The more tightly the gloves fit your hands, the more easily you can work.

9. Utility knife (optional). Lifting the corner of the negative with a blade as you peel it off the substrate may prevent smudging and keep the bottom edge of the image clean.

10. Rubber cement, masking or drafting tape, and scrap paper. Before soaking the substrate, you can outline the image shape with rubber cement or tape to ensure clean image edges in the finished transfer. Pat masking tape onto your clothing to remove some of its stickiness before pressing it onto paper because this way you are less likely to accidentally tear the paper when you lift off the tape later. Rubber cement can be lightly rubbed off the receiver after you transfer. Not only does this method allow for cleaner edges, but also it gives you the choice of not transferring a rectilinear image.

Before you begin the process, you can tape the damp receptor sheet down to a smooth, flat surface to prevent it from sliding around and blurring when you make the transfer. If you are working on a slippery substrate, such as vellum or silk, also taping the negative down helps to prevent it from slipping while you rub.

Scrap paper has two purposes. First, you may want to eliminate part of the image by cutting a shape from scrap paper and lightly rubber cementing it down on the receiver before you transfer. Proceed as described in steps 2 through 5 and remove the scrap paper afterward, thus revealing the substrate itself where the scrap paper formerly was. Or, for more even results, rubbing on a sheet of scrap paper placed over the back of the negative as you make the transfer helps. After you rub the negative, you may want to weight it to the substrate with a brick placed on the scrap paper.

11. Traditional marking materials (optional). You can embellish the transfer with color pencils, watercolors, pastels, dry pigment, and so forth. You may want to draw on the back of the negative with a ball point pen or cuticle stick to alter the transfer as it is developing. I use archival interleafing from art or framing shops to wrap around and store the finished print.

12. Clock or watch with second hand.

13. Cotton swab and pure rubbing alcohol (optional). After you finish the transfer, you can use a Q-tip™ or similar swab dipped in rubbing alcohol to purposely remove some emulsion on the edges and to clean up the white areas. On page 47 of Chapter 2 (Hand Coloring), you will find a description of how to prepare toothpicks or skewers with small pieces of absorbent cotton to make a disposable tool.

Tips

- After a session, always clean the rollers in the camera or the Polaroid back and the film exit slot because dirt can cause scratch lines on the image and old chemicals can create brown stains and clear spots. I use a lint-free material, such as Webril wipes or Photowipes™ with rubbing alcohol.
- Polaroid e-mails an informative newsletter, Pro Notes, that highlights creative techniques. Go to http://Polaroid/custhelp.com to sign up. They also manufacture an instant black-and-white photo positive (cannot be transferred) and special manipulatable, but not transferable, color film for their 600 series cameras.
- Transfers from live imagery with any film, although more uncertain due to the one-of-a-kind nature of the process, allow for adjustments in composition, focus, lighting, and exposure. The Light Factory advises the use of a 20 cc red filter or 30 cc magenta filter and an increase of one-half stop exposure due to the color shift caused by the transfer process with any film ending with a 9.
- The use of slides and transparencies allows for more easily creating an edition.
- You can double-expose in-camera or transfer one image on top of another. You can put two slides in the same mount, then overexpose, with a Daylab printer.
- As the dyes from the negative migrate to the receptor, yellow transfers first, then magenta, and lastly cyan. Because the film is peeled off after the yellow has transferred to the Polaroid positive,

but before it has a chance to migrate to your chosen substrate, you can correct for the tendency toward magenta and cyan in the transferred image by adding 10 cc or 20 cc of the red filter with a Daylab slide copier.

■ With black-and-white transparencies projected onto Polacolor film, you can use an amber filter for a sepia-toned transfer or a light blue filter to create a monochrome.

■ Polaroid suggests that, when you are removing the film from your camera, time the pull to match your saying the word "Polaroid" so that you do not draw it out too quickly or too slowly.

■ Thin papers, such as rice paper and tissue paper, cannot be soaked in the tray of water. Instead, try placing the negative on the dry paper, turning the sandwich over and spraying the back with an atomizer, then rubbing the negative to the paper.

■ Some artists wait a little longer than ten seconds, but no longer than 30 seconds, for the 690 film, before peeling the negative from the positive. By waiting too long, one runs the risk of ending up with a spotted blue cast because you miss any yellow or red transferring. If you peel before 10 seconds, you might wind up with the Sabattier effect (a partial image tone reversal) or fogging the film.

■ I quickly cut excess Polaroid packaging from around the picture before peeling the negative from the positive.

■ Once the negative is separated from the Polaroid positive, place it face down on your receptor sheet as quickly as possible because the dyes may dry and not transfer or ambient light may distort the colors.

■ When rubbing the back of the negative, do not go beyond the image area and do not rub too hard or the gel will ooze out onto your brayer or hand. Uneven pressure can cause blotching while too much pressure might cause the negative to shift and, therefore, to blur the print, especially on smooth paper.

■ If certain areas of the transfer seem to be lifting off as you remove the negative slowly from the substrate, stop peeling and try applying pressure to the back of that area. In small spots, I use the eraser end of a pencil to apply pressure. With heavier paper, you may find that if you allow the negative to sit on the receiver too long it becomes difficult to peel off because it dries on, so Polaroid suggests that you can soak the negative/receptor combination in a warm water bath for 15–30 seconds before peeling.

■ Transfers onto fabric may require more presoaking and more pressure.

■ Keep records of your procedure as you work so you can determine the effects of different variables. The direction of the grain of the paper, for instance, can influence the transfer.

■ You can get a second transfer from the same negative, even much after you performed the first transfer, by placing it on wet paper and running this unit through a litho or etching press.

■ *I cannot emphasize this tip enough:* Make sure you clean the camera rollers and film exit slot regularly with a lint-free cloth and either water or rubbing alcohol because dirt can cause scratch lines on the image, and old chemicals can create brown stains or portions where the image does not even print. In addition, inspect then clean the brayer in warm water.

■ All common color photography is sensitive to ultraviolet (UV) light, heat, and humidity, so Polaroid images should be stored in archival boxes with silica gel (I recycle the packets that come with vitamins) away from light and contaminants or framed and sealed under UV protective glass.

Making a Polaroid Transfer



1

Preparing the substrate

In a tray larger than the receiver, thoroughly soak 80 lb. paper in lukewarm, 75°F (24°C), water for at least 30 seconds, 110 lb. paper at least two minutes, and 300 lb. paper for five minutes. Completely squeegee or blot off excess water.



2

Creating the image

Either place your slide in the slide printer loaded with Polacolor peel-apart film and make an exposure, or shoot the scene with your Polaroid-backed camera. Then pull the white numbered tab, revealing the flap of the film.



3

Starting the processing

Put on protective gloves. Holding the flap securely, pull the film through the rollers in one, smooth motion. Wait only 5–10 seconds (or longer if the air temperature is cold), then either cut or pull the negative (black side) away from the Polaroid positive (white side). You can also cut the developer trap to avoid brown stains on the print and be sure to remove the lose white paper frame. Quickly place the negative face down onto the receptor. With 690 film, wait 30 seconds before peeling.



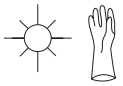
4

Applying pressure

Apply medium pressure for 30 seconds to the back of the negative with the side of your hand or a brayer. Make sure that you rub the entire back, concentrating more on the rear of dark image areas. Do not rub beyond the image or the chemicals will seep out onto your hand or the brayer. Let the "sandwich" sit, usually for 30 seconds, and roll it again. Then wait 30 seconds more. A hair dryer's heat on the back of the photo may aid in the migration of the dyes. You will have to experiment with different pressure, sitting times, and receptors.



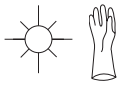
5



Peeling the negative

Put your fingers on the Polaroid as you *roll* back the negative, starting at one corner and *slowly* peeling on a diagonal. If part of the image starts to lift off, rub the image back in that area and try peeling the negative off again. You have a transfer when you have removed the negative completely!

6



Finishing the transfer

Before the paper completely dries, color can be lifted from the image with a blade. Excess chemicals along the image's edges can be removed with a foam brush or a paper towel. You may want to flatten the transfer print in a dry-mount press or under a hot iron, but make sure the print is protected with a clean sheet of interleafing. After the print dries, you can erase part of the image with very fine-grain sandpaper.



Stephanie Mehan Stigliano, *Detail from "Twenty-Five Memory Coins,"* **1-inch diameter each, Polaroid emulsion lift on bottle caps, sealed with polyurethane, 2004.**

The text consists of phrases which refer to dream fragments and surreal events. The set of coins, color coded as five orange, five green, five blue, five red, and five purple, fit into a small box bank. The above picture shows the first in a series of three boxes.

Polaroid Emulsion Lifts

An emulsion lift, in which you peel off the actual image layer of photographic dyes embedded in plastic and adhere it to your substrate, can be made with Polaroid type 669, 59, 559, or 809 film.

Safety

Please read the safety warnings for Polaroid transfers on page 13.

Hot water can scald, so be extra careful when you use it.

Materials

1. Polaroid equipment. Methods for creating Polaroid images are described on page 14.

2. Polaroid peel-apart color film. You will need a color photograph generated by film that ends in the number 9, which is described on page 15.

3. Receiver. Although usually adhered to good drawing paper, my students and I have attached emulsion lifts to furniture, glass, fabric, ceramics, mirrors, bottle cap interiors, plastic goggles, and other surfaces.

4. Water and two trays. Prepare one tray of very hot (160°F or 71°C) water and a second *ridgeless* tray of cold water. I use an electric fry pan for keeping the water hot because I can set the temperature to exactly 160°F. A plug-in tea pot and thermometer work, too. Using distilled water eliminates a variable that might cause problems. Tongs help in moving the photo from the hot water tray to the cold water tray.

5. Contact paper or spray paint. Used to prevent the photo backing from disintegrating or cracking while it is submerged in hot water, sticky-backed contact paper for shelves or spray paint of any color can be purchased at a hardware store. Either of these items should be applied to the photo's back when the picture is completely dry. Using scissors, cut the contact paper to match the size of the picture.

6. Clear acetate (optional). After your emulsion detaches from the Polaroid support, it might end up backward. Gently roll it under water onto a sheet of acetate or mylar so you can flip the emulsion over. In addition, my students have used acetate in order to lift the transfer out of the water and attach it to large sculptural objects. Two sheets of acetate are useful: one for reversing the direction and one if you are adhering the emulsion to an object.

7. Brayer (optional). I use the side of my hand to ensure smooth adhesion of the emulsion to the substrate, but some artists use a rubber brayer. This is a printer's ink roller, usually used for linoleum printing. Brayers can be purchased at art stores or hobby shops. Inexpensive substitutes include a kitchen rolling pin or a straight wine bottle rolled on its side.

Tips

- The white border of the Polacolor photo turns blue as it soaks in hot water. That border also tends to be more difficult to peel off the backing. So, if you do not need the border, trim it off before the first soak. However, the longer you let the polaroid dry (a day or two), the less likely you will have the blue border when you make the lift.
- Stretching or manipulating the emulsion is easier to do so while the receiver and image are wet, even partially submerged in a tray of water.
- Do not touch the emulsion unnecessarily or it will rip while it is wet.

- After the emulsion lift is completed and dry, you may want to spray it with fixative so that it is not as easily damaged. However, fixative is extremely toxic and hangs in the air after it is used. So, wear a respirator and gloves and spray outside or in a spray booth. I have had students apply one lift on top of another.
- A crystal may appear after the hot water cools. Although Polaroid says that this sediment is not hazardous, I advise wearing gloves as you clean the tray.
- *I cannot emphasize this tip enough* (*actually, this is the third such mention!*)*:* Make sure you clean the camera rollers and film exit slot regularly with a lint-free cloth and either water or rubbing alcohol because dirt can cause scratch lines on the image, and old chemicals can create brown stains or portions where the image does not even print. In addition, inspect then clean the brayer in warm water.
- All common color photography is sensitive to ultraviolet light, heat, and humidity, so Polaroid images should be stored in archival boxes with silica gel (I recycle the packets that come with vitamins) away from light and contaminants or framed and sealed under UV protective glass.
- You can separate the image, which is embedded in a resin-like coating, from the paper backing with Polaroid 600 film. By using a single edge razor blade, you strip the image from its white frame, then you wash the chemicals off the back of the picture. Wear gloves.

Making a Polaroid Lift



1



Taking the picture

Expose and process a sheet of film as you would normally. Let the photo dry completely overnight. In a pinch, you can dry the photo with the warm, not hot, setting on a hair dryer. Then, carefully reinforce the back (white part) with plastic contact paper or spray paint. Trim the contact paper to the size of the picture and burnish it so that there are no air bubbles. Let the backing dry.

2



Setting up

Warm up the water and pour it into a tray or leave the heated water in an electric frying pan. Use a thermometer to check the temperature, because you may need to add more hot water at intervals. Make another tray of cool water.

3



Heating the image

Gently submerge the photo face up the hot water. Let it sit for a few minutes, until you see the emulsion start to bubble, which is usually four minutes or more. If the water cools and the bubbling has not started, add more hot water.



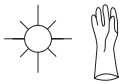
4



Preparing the receiver

Dampen, squeegee, and adhere a receiver, such as artist's paper, to a smooth surface as described in step 1 of Making a Polaroid Transfer.

5

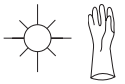


Lifting the emulsion

Pick up the photo with tongs and place it in the cold water. Wearing gloves, gently press the print, image-side up, to the bottom of the tray. With your other hand, push and lift the emulsion from the edges of the print so that it floats in the water. If the emulsion rolls up on itself, roll it flat against the Polaroid backing. Once the emulsion is free and flat, discard the paper backing.

In order for the finished piece to read correctly, slip a piece of acetate under the floating image and maneuver the image onto it. Flip the acetate/image over so that the image is face down in the water. Strip the acetate off. Slide fresh acetate under the emulsion, then stretch the image to remove wrinkles.

6



Adhering the image

If the image is already correct-reading, place the substrate under it in the water and, using your fingers, pinch two corners of the photo to the receiver, then gently scoop up the whole unit with the image on top. (If the image is wrong-reading, lift the acetate with the image from the water and carefully turn the unit, image side down, onto your wet paper or substrate.)

Gently rub and straighten the image, remove the acetate, then lightly roll the emulsion with your fingers or with a clean, soft rubber brayer from the middle outward, assuring the even adhesion of the emulsion to your chosen substrate.

Let the image dry in a clean area.

Magazine Lifts

Magazine lift provides another simple, versatile method of removing a printed image from its page. Lifts are made by adhering either heavy tape or acrylic (polymer) medium to a printed image to separate the ink embedded in the coating of the paper from the mass of the paper. The lift can be employed as a transparent page in a book, mounted in a slide holder and projected or scanned, stuffed and stitched, or warmed and sculpted. Another application is to enlarge or contact print a lift in a darkroom onto ortho film (see the Chapter 5 "Making Negatives: Analogue Method". Lifts can be used as the transparent halftone positive for photo silkscreen or as a decal to be adhered to surfaces such as fabric, acetate, paper, wood, glass, and ceramic.

Safety

No special precautions need be taken with materials used for making magazine lifts.

Method Overview

1. Printed image is selected and prepared.

2. Transparent tape, clear contact paper, or acrylic medium is applied to the front of the image.

3. When dry, the taped or coated image is then soaked in water until paper dissolves, separating the inked image from the paper.

Materials

1. Image. The inside pages of glossy magazines work best because the paper is coated with clay (kaolin), which is water-soluble. The ink rests on the kaolin, not the paper. Front and back covers do not work well because they are usually varnished, and this seals in the ink. Newspaper pages are thinner and often the images on both sides of the paper get lifted. For decal technique, color images from high-quality magazines are the most reliable. Choose slightly contrasty images with bright, detailed highlights and clear shadows to retain tonal separation.

2. Heavy transparent tape, clear contact paper, or clear acrylic polymer medium. These are the *adherents* used in the different lift methods. Transparent tape usually is available in hardware stores for winterizing windows or for mail room use (also known as clear packing tape) and is effective for smaller pictures. Clear contact paper used for lining shelves works with large pictures. Clear acrylic polymer medium (Hyplar™, Aquatex™, Liquitex™, etc.) is sold at art stores and provides the best flexibility in the final lift. Immediately after using the polymer medium, you must wash brushes with soap and water or the bristles will harden.

3. Metal spoon, burnisher, etching press, or paint brush. These are the *applicators* used in the various lift methods to assure adhesion of the magazine page to tape or contact paper, or, with the paint brush, to apply the polymer medium; a 1½ in. (4 cm) width soft brush is recommended.

4. Brayer. This is a printer's ink roller, usually used for linoleum printing but also practical for the polymer lift method when transferring onto fabric or acetate. Brayers can be purchased at art stores or hobby shops. Inexpensive substitutes include a kitchen rolling pin or a straight wine bottle rolled on its side.

5. Tub, sink, or dish pan and water.

6. Scissors.

7. Soft cloth. A clean, pressed piece of cloth is needed if you want to lift onto fabric, and another piece of absorbent cloth is necessary for blotting the fabric.

8. Blotter. For fabric lifts, a blotter the size of the fabric is needed.

9. Sheet of glass.

10. Receiver. Almost any paper or fabric or surface will work. Fabric, if used, should have medium weight and fine-woven texture for best results. Natural fibers and natural-synthetic blends work

better than synthetics. When applied to clear acetate, lifts can be layered, stitched, and stuffed. When heat-sealed to each other, lifts can be inflated to create sculptural forms.

11. Hair dryer. A hair dryer hastens drying time for polymer lifts and softens the polymer for sculpting decals.

12. White paper and acetate. For lifts onto clear acetate, you need a large piece of white paper, such as shelving paper.

Tips

- The acrylic medium method works best if you do not brush on thick coatings; otherwise the medium will penetrate too deeply into the paper fibers making delamination difficult. Rubbing or scrubbing the image as you apply the medium can smear the ink.
- Acrylic lifts can be used like decals. Make sure that the surface on which you want to place the decal is clean and dry. Then coat the surface with an even layer of polymer medium. Smooth the lift made by the acrylic (polymer) medium method onto the surface with the image right side up. Hold in place for several minutes. Remove excess medium with a moist cloth.
- To apply an acrylic medium lift to curved surfaces, gently heat the lift with a hair dryer until it becomes pliable, then apply the decal lift to a correctly prepared surface.
- When using acrylic polymer medium, be sure to immediately wipe excess medium off your work surfaces or receiver surfaces and implements using warm water and a sponge.
- To brighten the image after the fabric has dried, apply 80% watered-down coating of the medium to the image transfer area only.
- Acrylic lifts are sensitive to heat and cold. They will soften when warmed and become brittle when chilled, even if left outside on a cold day.

Making a Lift — Tape Method



1

Cutting and adhering the image

Cut out the magazine drawing, photograph, graphic, or type slightly larger than the image area. Press the sticky side of the tape or contact paper onto the image. Thoroughly rub the back side of the image with a spoon or burnisher, or put this sandwich construction through an etching press.



2

Soaking and drying the image

Float the taped or contact-papered image face up in warm water for 15 minutes. The paper will start to delaminate. Gently rub the back of the paper, removing the paper fibers but leaving the picture's ink stuck to the tape or contact paper.

Remove from water. Weight down the lift by the corners until the piece dries, then trim as desired with scissors.

Making a Lift — Acrylic-Medium Method



1

Preparing and coating the image

Cut out the image to be lifted, trimming off all extraneous areas. Place the image face up on a sheet of glass.

Apply a thin, even layer of acrylic medium by brushing with strokes going in the same direction. Air dry or blow dry, and coat again at a 90° angle to the first brushing. Dry again and coat again, repeating for a total of six to eight layers, alternating the direction of the brush strokes and drying thoroughly after each coating. The polymer medium should dry clear.



2

Soaking and drying the image

Float the acrylic-coated image face-up in warm water and soak it for 15 minutes.

The paper will become soft and start to delaminate. Gently rub the back of the paper to remove the paper fibers, leaving the inked image adhered to the acrylic medium. Artist Tricia Neumyer has had great success using a handheld steamer to remove the paper. Air dry or blow dry, if heat is needed to make the lift pliable.

Just by making simple alterations in the lift process, you can transfer images to fabric. Note that these transfers will have the image reversed, whereas the methods described previously produce images that read correctly. Lifts transferred to fabrics will be pliable in addition to being reversed.



1

Preparing the fabric and the image

Place a clean, pressed piece of fabric on a flat, hard surface. Select your image and trim all excess before placing it *face up* on a sheet of glass. Brush on an even, heavy coat of acrylic medium and wait about 30 seconds. The paper of the image will curl and look semitransparent, indicating that the medium has penetrated through the paper.



2

Combining the image and the fabric

Carefully set the wet, coated image face down on the fabric. Roll a brayer over the back of the image, pressing the fabric and picture tightly together, making sure to remove wrinkles. Turn the entire piece—image and fabric—over, and roll the brayer across the fabric. Test the image piece to see if it has adhered to the fabric by picking up the edges. If the image does not cling, remove the entire piece and recoat as in step 1 above, and reaffix the image piece to the fabric as described in this step.



3

Removing the paper backing and drying

Let the united fabric and image piece dry thoroughly, preferably overnight; then place the unit in a tub of warm water. After soaking for several minutes, the paper backing should peel away from the image with gentle rubbing. Remove the fabric from the water and lay it on a blotter, image side up. Gently wipe the image with a damp cloth to remove any pieces of paper that may remain. Hang the fabric to dry, and *do not wring*.

If any part of the image peels or pulls from the fabric along with the paper backing, resubmerge the whole unit and begin peeling from the center to avoid damaging the edges. Once the fabric has dried, use polymer medium to reglue the loose areas of the transfer.

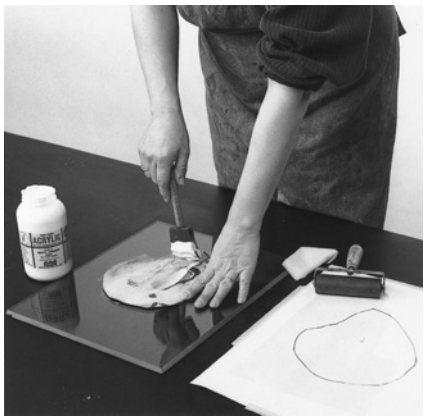
Images can be transferred onto acetate sheets, which are available at art stores. Like the lifts on fabric method above, this technique uses the acrylic-polymer medium to lift images from printed material to transfer onto a second receiver. In addition to providing a more rigid base, the transparency of the acetate together with the transparency of the dried polymer medium offers an alternative solution to the correct-reading/reverse-reading problem.



1

Preparing the image

Cover a flat work surface with a large white piece of paper, such as shelving paper, drawing paper, or typing paper, and secure this sheet to the work surface. Place the trimmed image page face up on the paper and carefully set a clean sheet of acetate over the image. Tape one edge of the acetate sheet to the white paper, creating a hinge, and then lift the acetate back open. Mark the outline of the image piece on the white sheet of paper.



2

Coating the image

Place the image face up on a sheet of glass, and apply an even coat of acrylic polymer medium. Return the picture coated side up to the outlined position on the white sheet of paper. Lower the acetate sheet and smooth it over onto the image piece. Untape the acetate sheet and turn it and the adhering picture over in order to roll the brayer across the back of the image. Lay the acetate-image unit on a flat surface, acetate side down, and wipe off any excess medium from the acetate with a damp cloth. Allow this unit to dry thoroughly, until the medium turns transparent.



3

Removing the paper backing

Place the acetate-image unit in a tray of warm water, paper side down. Soak for several minutes until the paper backing to the image piece is soft, then turn the unit over; gently rub the paper from the acrylic coating the acetate. Blot gently and allow the acetate sheet with the image adhered to it to dry.

Dorothy Imagire, *Tahirih, Feminist Martyr Iran, 1852,* **96 in. circle installation with 50 Lazertran™ decaled stones on rose buds, 2005.**

Tahirih was born in Persia—now Iran—in 1817. She was an intellectual and a poet, who refused to wear the veil. In 1852, she died a martyr for her beliefs; she was strangled to death by her own white silk scarf at night in a garden in Tehran. Her body was thrown down a dry well and covered with stones. Imagire captures her spirit by using Lazertran™ inkjet decals of Tahirih's poetry in Arabic and Persian, with some English translations, on the stones. The stones circling the rosebuds (originating in Iran, also mentioned in Tahirih's poetry) suggest a walled garden. Our word "paradise" is of Iranian origin, which literally translated means "walled garden."

As a young girl, Imagire, of the Baha'i faith, grew up knowing that Tahirih was the first woman martyr for the Babi/Baha'is. Imagire's mother was born and raised in Iran. www.imagire.org



Lazertran™ Inkjet Lifts, by Dorothy Imagire

A Lazertran™ inkjet lift is similar in look to Polaroid emulsion lifts, but much easier to do, and you can go directly from camera to digital printer. It does not "wiggle" like Polaroid—the decal is much firmer—yet somewhat flexible. Any image you have on your computer, whether scanned, imported, or created, can be printed out on Lazertran™.

Safety

No particular safety measures are required. Make sure you use a thermometer so you don't burn yourself with hot water.

Method Overview

1. Inkjet print your image onto Lazertran™ Inkjet Decal paper. Let the image dry.
2. Put the decal paper into warm water until it loosens from the backing paper.
3. Place the decal face up onto nonabsorbent receiving material.
4. If the receiving material is absorbent, coat the material first with an acrylic medium.

Materials

1. Image. You can use any image that is in your computer. Higher contrast and/or brighter colors show up better if placed on darker receiving material or transparent glass.

2. Lazertran™ Inkjet decal paper. You can purchase Lazertran™ online from www.lazertran.com. They have changed the name of some of their products, but look for "inkjet" and "waterslide" or "decal." They also make a nice inkjet iron-on transfer as well as many other intriguing products. They are based in England, but they also have a warehouse in the United States so that your order is shipped quickly in either location.

3. Receiving material. For porous materials such as paper, canvas, wood, or stone, you can attach the decal with acrylic medium while it is wet or attach it later when it is dry. In either case, coat the porous material with the medium, place the decal, and add another coat of medium on top of the decal. Make sure you brush from the center out to remove any trapped air. Lazertran™ also works well on nonporous materials such as glass, ceramic, and shiny metals without acrylic medium, adhering with just the gum on the back of the decal. Make sure you squeegee out any air bubbles and excess water.

4. Scissors. Small nail scissors work well when cutting intricate images.

5. Acrylic medium. Your can use either matte or gloss.

6. Freezer paper or waxed paper. Both are found in the grocery store. Freezer paper, which I prefer, has a plastic nonstick coating on one side (this is the side the decal should be placed on so it will not stick as it dries). Waxed paper sometimes works, but there is a chance the decal will stick to it.

7. Brush. Any soft brush you feel comfortable with.

8. Flat container or tray. Use any dish or pan that is larger than your cutout decal image and not too deep—about two or three inches.

9. Thermometer. An instant-read kitchen thermometer works quickly and is inexpensive, small, and easy to find. *Do not* use it for both cooking and nonfood processes.

10. Squeegee. May be useful on flat, nonporous surfaces.

11. Tissues or paper towels.

Tips

- For porous materials that need to be prepared with a coat of acrylic medium, you might want to brush the whole area, even beyond the image, because the medium is slightly visible. If the medium has dried, just apply a thin, wet coating before applying the decal.

- Nonporous materials do not need to be coated with acrylic medium, if the decal is applied wet. However if the decal has dried (a more practical method, which allows you more time to arrange images), attach the decal as you would on porous materials by first coating with acrylic medium, then applying a top coat of the medium.

- Clear or white areas on your image will not be see-through but slightly milky.

Making Lazertran™ Lifts



1

Making and preparing the image

Your image will not be reversed, so you do not have to flip it. Print on the cream side of Lazertran™ in an inkjet printer using "colorlife" setting if you have it. If you do not have the "colorlife" setting, the "matte" setting works well (whatever setting that does not use too much ink). Use the highest quality photograph setting at the highest dpi (1440 dpi if you have it) and do not check "high speed." Allow the inks to dry at least 30 minutes before continuing to the next step. Cut your image out, as the borders are visible when dry.



2

Preparing your receiving material

If you are using porous material, such as paper or canvas, you must coat it first with acrylic medium. Using a soft brush, evenly coat one layer of acrylic medium.

If you are using nonporous material, such as glass or metal, you do not need to coat it with acrylic. It should be clean and grease-free.



3

Releasing the decal

Fill a shallow pan, large enough to hold your image, with warm water at about 110°F (43.3°C). Lower the image into the water bath. Let it soak for 30 seconds to 1 minute. It will curl up then slowly flatten out again. Test to see if the backing slips away from the decal. If it slips away, take it out of the water, gently shaking off excess water.



4a

Attaching the image wet on porous material

Have your receiving material ready and at hand, coated with fresh, wet acrylic medium. Pull the decal one-quarter inch away from the backing and lay the image on the receiver face up. Now slide the rest of the Lazertran™ backing out from under the decal. Using a soft brush, add another coat of medium on top, working air and moisture out from the middle to the edges. The image will become more visible as it dries.



4b

Attaching the image wet on nonporous material

You do not have to use the acrylic medium. Place the decal face up and gently squeegee (the image is fragile while wet) with the side of your finger to push out air bubbles from the middle to the edges. Leave the unit to dry. The image will become more visible as it dries.



5

Attaching the image dry

If you want to dry the decal first, pull the backing one-quarter inch (5 cm) away on one side of the image and slide it onto a sheet of freezer paper. Now slide the rest of the backing out from under the decal. Let it dry until you are ready to use it. When you are ready, coat the receiving material (whether porous or not) with acrylic medium. Place the dried decal on the medium and brush on another coat of medium, working any air out from the middle to the edges.



Daguerreotype of Hand Colorist with Coloring Box, 2¾ × 3¼in. (7 × 8.5 cm). Sixth plate image ca. 1854, most likely American.
The sitter is most probably the daguerreotypist in the process of tinting an image, and his assistant probably took the exposure, which could explain why the image is a little soft. Notice that the colorist is holding a brush in one hand and a daguerreotype case in the other. This is a pose made with artistic license since he would have tinted the daguerreotype long before inserting it in the case. When the daguerreotype is in the case, the glass is already in place in front of the image and covers a mat and preserver and presses against a velvet lining and case.
Information and image from the Collection of Matthew Isenburg.

Chapter 2

Hand Coloring

- Water-Based Method 35
  - Method Overview
  - Materials
  - Watercoloring Method
- Oil-Based Method 42
  - Method Overview
  - Materials
  - Oil-Painting Method

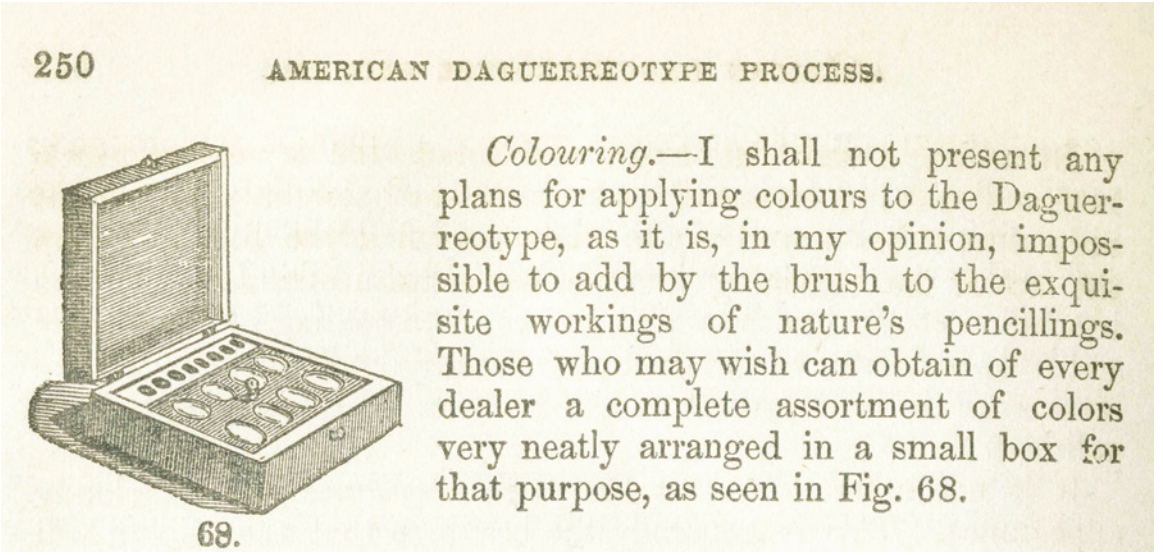
Hand coloring is a means by which you can add color to a photograph or photographic print, thereby expanding the visual and psychological impact. Those who do not feel comfortable drawing but do feel the need for painterly expression may find satisfaction in hand coloring a photograph or digital print; modeling, perspective, and anatomy are already apparent in the image. One need not have a darkroom; hand coloring should be done in indirect daylight or under daylight-balanced fluorescent or blue-frosted daylight bulbs.

From the beginning of photography, daguerreotypes (see Chapter 14), which were the first practical photographic process and announced publicly in 1839, were hand colored by the very artists who had previously been hired by patrons to paint miniature portraits. The reproduction on the opposite page shows such a hand colorist with his materials, although it should be pointed out that many women were employed in this craft. The neutral gray tones were not popular with sitters, so studios devised a method of dusting or lightly stippling with a fine brush a powdered pigment and mixing it with gum arabic on the delicate picture, then "fixing" the surface with the painter's breath. Or, the colors were mixed in alcohol and brushed on so that they would dry rapidly to a visible tint. (You might mistake the pale blue areas in daguerreotype highlights with hand coloring, but the azure tinge often was due to over exposure.) Yet, right from the beginning, an ethical and aesthetic debate arose whether it was "impossible to add by the brush to the exquisite workings of nature's pencillings."[1] Even today, I know of traditionalists who find altering the "truthfulness" of photographs to be offensive, yet every time a photographer frames the world and excludes part of it, the image is just that—an image.

A few decades later, tintypes, a less expensive and, therefore, more popular form of photography with clientele from diverse economic backgrounds, were sometimes hand colored. The amount of time taken to paint and the reputation of the painter influenced the price, so less affluent sitters might ask for only rosy cheeks, whereas more expensive and completely colored portraits were seen as status symbols.[2] The process of overpainting, where the layers of pigment are so dense that the photographic image is largely hidden, is seen in the figure on the next page. Some of the questionable advantages of such a method, used before airbrushing and Adobe Photoshop®, were to hide "flaws" and even to pass as a painting!

[1] A quote sent to me by Matthew Isenburg from an old explanation of the American daguerreotype process.
[2] Henisch, Heinz K., and Bridget A. Henisch. *The Painted Photograph, 1839–1914: Origins, Techniques, Aspirations*. University Park: Pennsylvania State University Press, 1996.

The exact coloring kit on the table of the daguerreotype reproduced at the beginning of this chapter was originally illustrated in Robert Hunt's *Photography*, with additions by the American Editor, S. D. Humphrey, New York, 1852, p. 250. Courtesy of Matthew Isenburg.



250 AMERICAN DAGUERREOTYPE PROCESS.

68.

Colouring.—I shall not present any plans for applying colours to the Daguerreotype, as it is, in my opinion, impossible to add by the brush to the exquisite workings of nature's pencillings. Those who may wish can obtain of every dealer a complete assortment of colors very neatly arranged in a small box for that purpose, as seen in Fig. 68.



Tintype with overpainting, 6 × 8½ in. (15.25 × 21.5 cm). The image probably used to be in an oval frame. Collection of the author.

Before color photography became widely available and relatively inexpensive, studio photographers hired artists to apply transparent layers of thinned oil paints or water-based aniline dyes onto black-and-white portrait photographs, a method also referred to as hand tinting. Multiple layers of color were built up as the artist allowed each coating of paint or dye to dry and harden before adding another layer. Many advertising firms today use hand-colored touch-ups of color photographs to infuse objects with more vibrant color than they originally possessed, although digital imaging and touch-up are even more common. Colorists also are sometimes hired to add color into black-and-white photographic murals. I often use a system of purposely creating gray-and-white digital prints or photocopies on paper from my black-and-white negatives, then opaquely pasteling over them, because certain inkjet papers also can be covered with oil-based and chalk-based mediums, as exemplified by my artwork on the cover. I advise against trying to salvage an unsuccessful photograph; it will look like a bad photo with colors on top.

The two major categories of materials for hand coloring traditional photographs are water-based (toners, dyes, and watercolors) and oil-based (oil paints and special photo oils), which may be used alone or in combination with each other. If you combine the two methods, it is advisable to apply water-based colors first because oil-based materials will adhere to water-based ones, while water-based materials do not cover well over oil. Although I use pastels over digital prints on rag drawing paper, special matte resin-coated photo papers also accept pastels.

Selection of the coloring agent depends on whether you wish to apply color to a glossy photograph (water-based materials work more easily) or matte photograph (either oil- or water-based colors can be used), and the effect you wish to achieve (water-based colors seep into the gelatin

Erica Daborn, 21¾ × 20 in, (54 × 50 cm), Gouache, pencil, ink over inkjet print of enlarged bookplate, 2005.

The drawings are made over carefully selected 1940's and 1950's photographic book pages, but the idea of transformation is central. The photographic fragment and what might be a deliberately crude drawing are forced to "live" together, thereby breaking down the distinction between traditional notions of the document and invention.



Interplay: Camera.



Interplay: Seedpods.

coating of a photograph or the image area of a print allowing the detail of the photograph and texture of the paper to show; oil paints rest on the surface of the picture and can cover up photographic detail and the texture of the paper). Both oil-based and water-based colors can be applied to selective areas or the entire image, on paper as well as fabric. If you are hand coloring a digital print, the oil-based method does not work well because the oil seeps into the paper fiber and can yellow it over time.

Always start with a completely processed and carefully washed photograph. Oil paints work best on dry prints, while water colors, toners, and dyes work best on damp prints.

Water-Based Method

Water-based materials come in a wide variety of colors and types, and they work well on many surfaces. Once you feel comfortable with the suggested procedure for water-based coloring, don't be afraid to experiment. Many exciting results come from techniques that are not supposed to work.

Safety

Certain colors, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, burnt umber, raw umber, Mars brown, lamp black, and vermillion, can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a ventilating mask and protective hand cream, working in a ventilated area, and carefully washing hands and cleaning fingernails with soap and water—not solvents—after using these pigments can help prevent accidental poisoning or ingestion of the colors. Never point the tip of a brush by putting it in your mouth.

Wear goggles and protective gloves to avoid eye contact with wetting agents and other chemicals.

Never smoke or eat while you are painting.

Method Overview

1. Photograph or photographic print is prepared.
2. In daylight or mixture of fluorescent and incandescent light, colors are applied to build up areas or layers.
3. Print is fixed to protect colors, or print is allowed to dry.

Materials

1. Image. Black-and-white, toned, or color photographs are fine. Almost any fiber-based photo paper works well with water-based materials. Bergger and Kentmere (Au2) (which produces Document Art and Textured Warmtone, both with a rough surface good for hand coloring) can be purchased at Freestyle Sales in the United States and are listed in the Supply Sources. In addition, Kodak's P-Max Art and Luminos' RCR-Art are medium-weight, resin-coated papers that are intended for hand coloring, but both Luminos and Kodak have announced that they will cease manufacturing silver-based papers in 2006, so stock up now! Some of the smaller manufacturers will probably be the sole sources of any black-and-white photo papers in short time, so check out J and C Photo, listed in the Supply Sources, because they carry these black-and-white fiber papers: Adox with its high silver content, Foma contact speed, Efke, and J and C Heavyweight. Ilford is still making their Matt multigrade IV FB and wonderful Ilfobrom Galerie FB.

Using methods described later in this book, photographic prints on artists' rag paper will take water-based colors, but both photo paper and drawing/watercolor paper must be flattened or a crack or crease will show up as a dark streak when you color the picture. If you are working on a glossy print, use less water when mixing the tint. Natural or natural-synthetic fabrics will accept water-based colorants more easily if the cloth is ironed or tightened over canvas stretchers first, although most water-based paints fade when fabric is washed.

2. Colors. Water-based substances include Marshall's Retouch Colors, Kodak Retouching Colors, Veronica Cass Liquid Colors (only found on eBay), Colorvir® dyes, Nicholson's Peerless Transparent Water Colors, PEBEO liquid toners, artists' watercolors and acrylic paints, food coloring, coffee, tea, batik dyes, photo chemicals (see Chapter 15, Chromoskedasic Painting section) and felt tip pens. I have found

Dr. Ph. Martin's Synchromatic Transparent Colors to be the most intense. Marshall's and Kodak's (again, I am not sure how long Kodak will make these available) retouch colors and Dr. Martin's and Veronica Cass' colors come in bottles of concentrated dyes that can be purchased at photography stores. They can be diluted with water before use and they also can be air brushed, as can Badger Air Brush Colors.

Nicholson's Peerless Watercolors, available at art stores, come in two forms: concentrated liquid and dry sheet. They are made for application on black-and-white photographic paper and the dry sheets are great to travel with because they are packaged as booklets of color-saturated sheets. They can be wetted with a brush for application directly onto the image. Or a piece of the sheet can be cut off, placed in a bowl, and covered with just enough water to dissolve the color from the sheet. Excess color can be blotted off with the blotter supplied in the booklet or removed entirely by immersing the print face down in a pan of water.

Food coloring found in grocery stores (the least expensive coloring agent) or tubes of watercolor paints from art stores can be applied to photos if a wetting agent, such as Kodak's Photo-Flo or Ox Gall, purchased at an art store, is added to either of them before use. Food coloring, however, is difficult to remove from a print after it has been applied. Ralph Hattersley suggests using medicinal dyes, such as merthiolate (shocking pink) and gentian violet (purple) to extend the limited range of food colors (*Photographic Printing*, 1977, p. 221). See the tips on page 58 in Chapter 3 for more ideas concerning medicinal and food dyes.

On black-and-white photos, I have taken to drawing with color spotting pens, which are intended for getting rid of problems in color photos. Alcohol-based permanent markers can add a wet-on-wet color quality to glossy photographs and laser color copies, while nonpermanent felt-tip pens are great for tiny areas. Marvy makes the flash-out photo pen, which consists of a fine point for getting rid of red-eye, but works for coloring too. But most ingenious of all is Zig Photo twin markers, which look like markers but have both a fine and broad brush on each pen. And one colorist recommends fluid makeup from any cosmetic manufacturer, if you use it on a matte surface and let it dry thoroughly for a few minutes after applying it.

Photographic prints on sized or unsized artists' papers and fabric images made by the techniques described in this book take to water-based materials in varying degrees. Artists'-quality watercolor paints and water-based felt pens work well, as do retouch colors and Peerless colors, colored pencils (Prisma is my favorite brand), crayons, and pastels. Sanford produces Col-erase colored pencils specifically for use on blueprints and engineering drawings, and they come in 24 colors. For fabric, Binney and Smith makes Crayola Craft™ fabric crayons and fabric markers, and Pentel makes Fabricfun™ pastel dye sticks and crayons. Perusing the aisles of a craft store will offer imaginative possibilities for adding color to fabric and rag paper. I have liked using procion natural dyes with an alginate thickener so that I can paint without the color bleeding on natural fabrics. Because these dyes change the color of each fiber, rather than staining or sitting atop the fabric, they are more permanent.

3. Toothpicks, skewers, cotton swabs, cotton balls, sable water color brushes, or cosmetic sponge. By wrapping a thin piece of absorbent cotton around a toothpick or a bamboo skewer (available in butcher shops and barbeque suppliers), you can make an inexpensive, disposable tool for coloring

details. A damp sponge or cotton ball lightly wiped over the surface of a photograph facilitates the application of colors in large areas.

4. Ilford Ilfotol, Kodak Photo-Flo, Edwal Wetting Agent, Ox Gall, liquid dish soap, or an equivalent wetting agent by other manufacturers can be purchased from a photography store (wetting agents are usually used when developing film) or art store. See item 2 above about food coloring. Mixing a strong solution of wetting agent, such as a few drops to 2 oz (59 ml) distilled water will create a solution that can be carefully swabbed onto an unwanted color to remove it from an area that has been hand colored.

5. Water. You do not need running water, but you will need a tray of 32 oz (946 ml) of water at room temperature. You may need a beaker to dilute the wetting agent with water.

6. Household bleach or household ammonia can be diluted with water, picked up on a cotton swab, and gently rubbed on undesirable color for partial removal of that color. Too much rubbing, however, will lift off the emulsion of that image.

7. Masking tape is needed to secure the print to your work surface. Make the tape less sticky and less likely to damage your print by patting a length of it onto your clothes before using it. When you are finished coloring, you can remove the tape easily, leaving the print with clean borders. For prints on artists' paper, drafting tape is less sticky and will not rip artwork when removed. I prefer the acid-free artists' masking tape for archival reasons. In addition, masking liquid, as described on page (57, item 4), will assure white borders.

8. Newspaper or glass protects a tabletop from stains caused by the dyes. Make sure that your work surface is smooth, because indentations show up as imperfections in the colored area of the image and roomy so that you do not have to worry about spills.

9. Facial tissues such as Scott Precision Wipes, can blot liquid color and wipe the brush of excess color. Or, you can use white blotter paper to gain control over the strength of the applied color. Protective silicon hand cream from a hardware store is needed if you plan to apply color without wearing gloves.

10. Medicine dropper, available at drug stores, controls the dilution of mixed solutions. A measuring cup is needed for mixing the solution. Some colorists use a magnifying glass or lamp with magnifying lens for detailed work.

11. Bowls or paper cups. Use small white bowls or paper cups to hold diluted colors. A white ice cube tray also makes an efficient palette, as does the white plastic watercolor palettes available at an art supply store.

Tips

■ As with numerous processes in art, beginners will avoid some frustrations if they start small, get used to the procedure, and then work larger if desired. I recommend you start with an 8 × 10 in. (20.5 × 25.5 cm) photo that does not contain many small details. If you cannot afford the lamps with fluorescent and incandescent bulbs, set up near a window so that you work with a combination of indirect sunlight and a desk lamp.

■ Highlights, shadows, and modeling in the photographic print can show through the layers of paint. Start with a color lighter than you want, and slowly build up layers until the desired chroma is achieved.

■ Kentmere, and Arista (see Supply Sources) manufacture double-weight, black-and-white matte or glossy fiber photo paper in rolls, which is processed with conventional darkroom chemicals. Where I teach, we have set up a system of large garden troughs filled with processing chemicals because it is nearly impossible to find huge trays. In Chapter 4, however, I describe a method for constructing oversize trays, but you need a sink large enough for them to fit. Students roll the large sheets through the chemicals and within the trough in one direction, then back in the other direction. They have to wear gloves! After the image is dry it can be torn, toned (see Chapter 3), or drawn onto with colored pencils and other media. Kodak stopped making mural paper in 1987.

Watercoloring Method



1

Securing the image

Press 2 in. (5 cm) of masking or drafting tape to the work surface. Continue pressing half the tape flush to the border of the image, and half the tape to the work surface, with 2 in. extending beyond the print. Tape down all sides of the print in this fashion. Rubber cement (used as described on page 46, Frisket) can mask out areas that you do not want to tint.



2

Preparing the toothpicks

Fray the edges of a ½ × ½in. (1.25 × 1.25 cm) piece of cotton. Moisten the tip of a toothpick in water and place it in the center of the cotton. Fold the cotton over the tip and wind the cotton tightly up the shaft, away from the point. Make at least six toothpicks, skewers, or sandwich toothpicks.



3

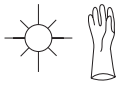
Preparing the palette

Squirt one drop of each color or squeeze a pea-sized amount of pigment into separate bowls or cups, or mix different colors in the same cup to create new hues.

Using a medicine dropper and a measuring cup, mix one drop of wetting agent to 4 oz (114 ml) of water. Add drops of this diluted wetting agent to each bowl of color until you make the tint a shade lighter than you want on the print. Mix thoroughly. Save the unused, diluted wetting agent.



4

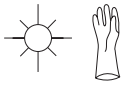


Applying color

Dip a clean cotton ball or sponge in the diluted wetting agent, and lightly wipe the photograph or print.

Saturate another cotton ball with the wetting agent/color mixture, then apply the color lightly to a large area (such as the background) by quickly stroking the image with the color. If the hue is too light, resaturate the cotton ball and reapply the wetting agent and color to the picture.

5



Removing color (optional)

In a cup, mix one drop of bleach to ten drops of water. Saturate a cotton swab with this mixture, and lightly rub an area of unwanted color with the swab. Blot the area dry with tissues or blotter paper.



6



Adding new colors

Dip a fresh cotton swab into another bowl of color, and stroke the swab in a new area of the image. Remove unwanted color as in step 5. A cotton-wrapped toothpick, pointed sable brush with less color, or a felt tip pen, works in small areas. Clean brushes in water after each use.

7



Finishing the print

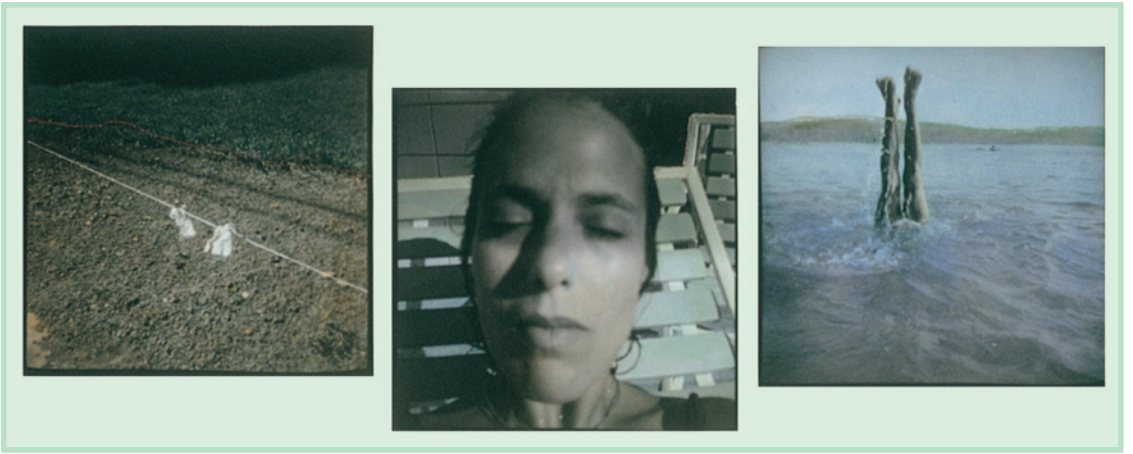
Air dry the colored print overnight. If you want to work further on the print, you can use more water-based color or oil-based pigments.

Carefully remove the masking tape after you have completed coloring.



Benno Friedman, *Sea View, from Big Ones series, 40 × 55 in. altered black-and-white-photograph, 1986.*

Benno Friedman's background as a painter has influenced his personal photography. Using a variety of artists' media on a dry photograph, Friedman found he had more control and a greater range of surfaces, textures, and palettes. His process was multistaged: he ripped and repositioned pieces of his 11 × 14 in. (28 × 35.5 cm) black-and-white photographs. He rephotographed that collage and made a 16 × 20 in. (44 × 51 cm) print, which he bleached in part and drew on with graphite. That new image was rephotographed and a black-and-white print was made. He bleached and drew on it with pencil, spray enamel, charcoal, graphite, oil pastel, or any technical means to achieve the desired end.



Laura Blacklow, **"untitled, from Shore Pictures," 1980**. *19 × 26 in. hand-colored black-and-white photographs stitched onto rag paper.* **www.lblacklow.com**

Oil-Based Method

Oil-based hand-coloring materials are easier to control and apply than water-based ones. Mistakes made with oil paints and photo oils can be removed easily, and prints can be reworked, yet oil-based paints have the greatest permanence of all hand-coloring materials.

Safety

Turpentine (found in Marshall's Photo Oils Prepared Medium Solution) can cause skin and respiratory irritation, allergic reaction, and kidney damage, sometimes years after exposure. It is highly poisonous if ingested and should be stored out of children's reach. Wear a ventilating mask and protective gloves and work in a well-ventilated area.

Certain pigments, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermilion, can lead to poisoning and physical harm if they are ingested or inhaled frequently. Try to substitute other, less-harmful pigments, wear a ventilating mask, and work in a ventilated area. Carefully washing hands and cleaning fingernails after using these colors can help prevent accidental poisoning or ingestion of the colors.

Never smoke or eat while painting, and do not allow any painting materials to come into contact with your face.

Marshall's Pre-Color Spray and other primers are toxic and highly flammable, so do not use them near an open flame or throw the empty can into a fire. Spray outdoors or in a very well-ventilated room while you wear a mask.

Trichlorethylene, found in Marshall's Marlene, is a suspected cancer-producing agent. It is highly toxic by inhalation and ingestion, causing possible nervous system disorders and reproductive system problems.[3] I strongly urge you not to use it, but if you must, be sure to wear protective gloves and a vapor mask and work in a well-ventilated area (i.e., one that has 20 changes of air per hour). In the presence of flames, even lighted cigarettes, and ultraviolet light, trichlorethylene can decompose into a toxic gas. It is flammable if heated. Instead, substitute gum turpentine, which is moderately toxic by skin contact and inhalation but extremely toxic by ingestion. Chronic exposure to turpentine can cause serious kidney problems and allergic sensitization, which may not show up until after years of exposure.

Method Overview

1. Photograph or photographic print is prepared.
2. In daylight or mixture of fluorescent and incandescent light, colors are applied to build up areas or layers.
3. Print is fixed to protect colors, or print is allowed to dry.

Materials

1. Image. Black-and-white, toned, or color photographs work fine. Suitable fiber papers include Bergger Semi Matte, Forte Matte, Kentmrere, and some of the smaller manufacturers, who will probably be the sole sources of any kind black-and-white photo papers in short time. Check out J and C Photo (see Supply Sources) because they carry Adox with its high silver content, Foma contact speed, Efke, and J and C Heavyweight, all black-and-white fiber papers. I have used glossy photo paper, but matte and semimatte are much easier. If you are starting with a glossy print, a layer of Marshall's Pre-Color Spray makes the surface easier on which to apply color.

Luminos made R.C.R.-Art (graded, available in sheets and rolls) and Kodak made P-Max Art RC (graded) warm black paper specifically for hand coloring. Luminos, Kodak, and Agfa ceased manufacturing silver-based papers in 2006, but some can be purchased via eBay. Another usable matte resin-coated paper is Ilford Multigrade Pearl. Ilford might soon change all their silver-based papers to special-order items.

Photographs should be dry and flat because a crack in a print will show up as a dark streak of color. Work from a technically good and slightly light photograph—it is difficult to conceal a muddy image. Some photographers prefer first toning the photo (Chapter 3) before hand coloring so they can change the blacks and even the paper base. Other variables to consider include the contrast, or amount of black, white, and gray; the image tone (whether it is a warm brown-black, a cool blue-black, or a neutral green-black); and the base of the photo paper itself, which can be bright white or off-white. You might find it less frustrating and less expensive to start with an 8 × 10 in.

[3] Trichlorethylene products have been associated with a risk of "Sudden Sniffing Death" due to fatal heart abnormalities.

(20.5 × 25.5 cm) image with simple shapes and work up to larger, more complicated pictures. Making several copies of the same image frees you up to practice and experiment.

Fabrics such as linen and other natural fibers accept oil-based colorants and work best if first ironed or pulled over canvas stretchers.

I send (unprepared) fairly smooth rag printmaking papers, such as Lanaquarelle, Rives Heavyweight, and even Rives BFK through inkjet printers because I want a soft and flat print. Afterward, I cannot use water-based materials to color because they will dissolve the digital ink. I use traditional pastels while wearing a dust mask and skin-protecting lotion. However, if you know Adobe Photoshop® and want a more vibrant image, you can purposely saturate the picture to increase its intensity when digitally printing onto unprepared papers, to counterbalance the color sinking in. You can also use rag digital papers, such as those made by Hahnemuhle and Somerset, and fabrics especially coated for digital printers with mediums, such as oil paints, but you should test the substrate first by placing a drop of linseed or vegetable oil on the coated side, then seeing if the oil goes through and stains the back after a day, indicating that it will not work. If you are going to make a digital picture for your base, I advise that you use the more archival pigment inks in your printer and test on small pieces of paper to save money and the environment by discarding less paper.

My students have successfully ironed thin papers and fabrics onto wax paper, sent the two through the printer, then easily peeled the wax paper off afterward. When color printers were first being introduced, I was invited to try one out by the Massachusetts Institute of Technology. I think I might have given the technicians a heart attack when I applied and ironed many layers of spray starch on the back of synthetic satin, but this method stiffened the fabric so it behaved like paper, and it worked! William Paul & Associates (see Supply Sources) sells Vesta inkjet cotton canvas and Brandess/Kalt/Aetna (see Supply Sources) sells Marshall's InkJet Canvas and Photo Oil sets for running through digital printers. They are water-resistant and have a matte surface.

Schminke et al., the authors of *Digital Art Studio* (see Bibliography) explain how to use digital printers with leather, matte board, corrugated cardboard, and other surfaces, but they are careful to use a special precoat and to make sure that the materials are not too thick to fit through the printer. Artist Marcia Ciro runs aluminum plates through an Epson 1280 loaded with Ink Aid inks.

2. Oil-based colors. Paints made especially for application onto photographs include Marshall's Photo Oil Colors, the highly recommended French Colorvir® colors, and Veronica Cass Oil Colors (available only on eBay). For saturated hues, see Brandess/Kalt and Marshall's Extra Strong Colors in the Supply Sources. Marshall's also manufactures Photo Oil Pencils and pencil blender, great for coloring small details, and extender, which has a variety of uses. The addition of extender to Marshall's oil colors creates more subtle hues, helps move color across the photo's surface and works well for cleaning paint away from small areas. The extender, Grumbacher Transparentizing Gel, or Weber Res-N-Gel, in art stores, can be mixed with traditional artists' oil paints for easier application onto photos or for thinning a color so that the highlight detail, shadow, and modeling of the photograph show through the layer of color. Marshall's Introductory Kit does not include extender, but you can buy a separate tube.

The photograph can act like a painter's underpainting, and the layers of color act like a painter's glazes. Allow one layer of color to dry before adding another.

3. Cotton balls and cotton swabs. Cotton balls or absorbent cotton apply color in large areas of the picture, while swabs such as Q-tips blend the edges of areas of different colors. Both products are available in drugstores. Keep applicators clean for each color or you will get mud.

4. Toothpicks, bamboo or metal skewers, sandwich toothpicks, and pointed red sable brushes. By wrapping a thin piece of absorbent cotton around a toothpick or a wooden hibachi skewer (available in butcher shops), you can make an inexpensive, disposable tool for coloring details and removing unwanted paint from small areas. Because the hibachi skewer is long, it is great for reaching the bottom of an almost-empty bottle. You can order extra Marshall's skewers from Brandess/Kalt/Aetna (see Supply Sources). Keep applicators, whether brushes or cotton on skewers, clean so that you will not end up with muddy colors.

5. Palette. A sheet of glass underlined with white paper or a white china plate best displays true colors, and you can mix colors on such a palette. The disposable paper palettes available in art stores, acetate, or interleafing clipped to white cardboard also work well. Wax paper is not advisable because the wax can chip into the paint.

6. Surface preparation. Rectified gum turpentine (sold at art stores) or Marshall's Prepared Medium Solution is wiped over the surface of an uncolored photograph to make the colors spread more easily. Kira Brown, in *Photo Techniques Magazine* (September/October, 2000), advises to be careful not to oversaturate the surface or the colors will not stay on the photograph well; squeeze most of the liquid out of a cotton ball before beginning and do not press down too hard. Allow the solution to dry until the surface is soft, but not slick. In addition, either of these solvents soaked onto a cotton swab can be used to soften the tips of colored pencils for a less streaky effect. Use Turpentine and P.M. Solution to clean unwanted oil paint.

Grumbacher's or Marshall's Pre-Color Spray dulls glossy photos and thus makes the image surface easier to work on. Marshall's recommends using Marlene to remove unwanted paint, but it will also strip these primer sprays off the photo. Use a kneaded eraser instead.

You do not have to prepare photographic prints on traditional artists' paper unless the paper grips colors too much for you to control; Marshall's Pre-Color Spray helps avoid stains from the paints.

7. Kneaded eraser or Marshall's Prepared Medium Solution can remove small areas of unwanted color—this must be done before the paint dries and hardens. Kneaded erasers, such as Faber Castell Peel-Off Magic Rub nonabrasive erasers, are sold at art stores and are made of malleable rubber that can be worked to a fine point. Eraser particles can be dusted off with canned air.

8. Fixative (optional) can be used to protect the surface after an image has been painted and dried. Fixatives are sold in art stores, but not all are of archival quality because they can yellow a print within a few years. Spray fixatives are very toxic if inhaled, and a ventilating mask should be worn when you use them. Schminke et al., in *Digital Art Studio* (see Bibliography), offer a postcoat formula you can mix from acrylic-matte medium and isopropyl alcohol.

9. Facial tissues without additives such as aloe or oil. Because of health risks (refer to Safety section), color should be smoothed on with a finger covered with a tissue, such as Scott Precision wipes, or a soft piece of cloth, such as an old handkerchief. Protective silicon hand cream from a hardware store is needed if you plan to rub color in with your bare fingers.

10. Masking tape is needed to secure the print to your work surface. Make it less sticky and less likely to damage your print by patting a length onto your clothes before using it. When you are finished coloring, you can remove the tape easily, leaving the print with clean borders. For prints on artists' paper, drafting tape, which is less sticky, is advised because it will not rip your artwork when removed. Or, use the tape to avoid getting color onto the border if you want the edges to be clean.

Badger's Foto Frisket Film can keep the borders white as well as temporarily seal a color when you apply another color near it. The film comes in a roll that is cut with a sharp blade in daylight. Grafix makes a liquid white frisket that is put on with a special pen nib. Dr. Ph. Martin manufacturers a white frisket, and Grumbacher makes the funniest color of all—fluorescent orange—in their Miskit Liquid Frisket! All friskets peel off afterward and wash out of pens and brushes with soap and water. I also use neutral pH rubber cement, which I mix with red food coloring so that I can see where I have laid down the mask.

11. Newspaper or glass protects a tabletop from stains caused by turpentine and oils. Make sure that your work surface is smooth, because indentations will show up as imperfections in the colored area of the image.

12. Spotting fluids, retouch colors, or spotting pens, available at photography stores, eliminate white marks on the photo, often caused by dust on the negative when it is being printed. Follow the manufacturer's instructions and spot before you paint.

Tips

- See tips for water-based materials, page 38.

- Almost any brand of artists' colored and graphite pencils, crayons, dry dyes (such as Kodak Retouching Colors) and pastels can be used on photographs if you prepare the surface beforehand with a layer of workable fixative, or Grumbacher's or Marshall's Pre-Color Spray, available at art stores. All of these sprays are toxic and flammable, so treat photos outdoors or in a strongly ventilated area.

- After applying pencil color to the print surface, rub it in with a cotton ball or swab.

- Highlights, shadows, and modeling in the photographic print can show through the layers of paint. Start with a color paler than what you want and slowly build up layers until the desired chroma is reached. Once a color has dried onto the photograph, never use P.M. Solution or turpentine to work more color into that area—these preparations can loosen the underpainting.

- I tend to work from the inside to the outside of an image and to turn the photo upside down so as not to smudge paint already on it. I also find it easier to work with a sheet of clean paper toweling under my wrist and to wait a few hours for the first layer of color to set before adding a hue on top.

- Days later, paint on a palette may dry and form a skin, but you can prick the skin with a toothpick, remove it, and use the loose paint underneath. (If a cap on a tube of paint sticks, you can loosen it by holding a lighted match under the cap for a few seconds.)

Oil-Painting Method



1



Setting up

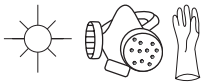
Press a length of masking or drafting tape half to the work surface and half along the border of the image and beyond the print. Tape down all sides of the print in this fashion. Use Frisket along the white border (optional). Spot the print to eliminate printing imperfections.

Set out all colors by squeezing pea-sized amounts onto the palette. Arranging in color groups may make work easier.





2

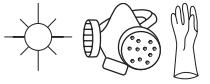


Preparing the toothpicks and photo

Fray the edges of a ½ × ½ in. (1.25 × 1.25 cm) piece of cotton. Moisten the tip of a toothpick and place it in the center of the cotton. Fold the cotton over the tip and wind the cotton tightly up the shaft, away from the point. Make at least six toothpicks or skewers.

Saturate a cotton ball with P.M. Solution or turpentine. Carefully rub the entire photograph with the cotton, then use a facial tissue to evenly wipe off the excess until the print appears dry. You may need to re-prime areas if you continue to work a day or two later. Prepare glossy surfaces with Marshall's Pre-Color Spray. Hold the can 12 in. (30½ cm) from the print and spray back and forth. After the coating has dried, spray the print using an up-and-down motion. Matte surfaces may need no preparation.

5



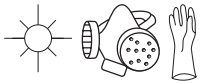
Blending colors

Use your finger, protected with silicon cream, a tissue, or dry cotton to rub paint and blend edges of an area. Always rub down each area and remove excess paint before applying color to an adjacent area.

Use a fresh cotton swab and $^{1}/_{16}$ tsp of paint to apply another color to a medium-sized area. Clean the print as previously described. A cotton-wrapped toothpick with less paint or photo pencils will work to apply color in small areas. Paint as much of the image as you want.



3

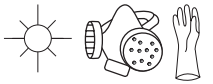


Applying color

Use colors straight or mix colors on the palette by blending paint with a cotton swab. Pick up approximately ⅛ tsp of paint on a cotton ball and rub it into a large area, such as the background. Do not worry about keeping the color within a border, but keep rubbing the color until it is smooth and does not glisten when viewed from an angle.



4



Cleaning the print

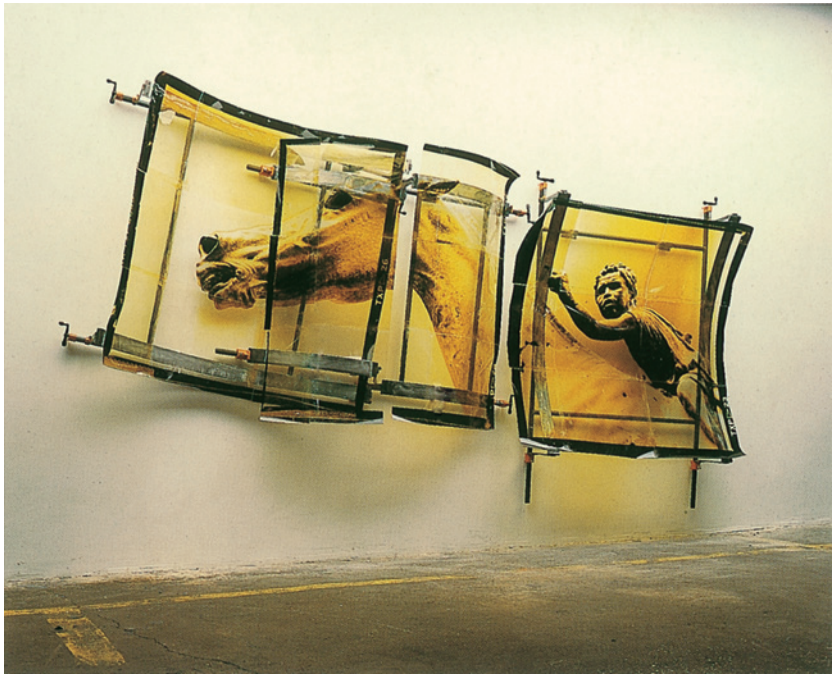
If color overruns an area, clean it off with a cotton-wrapped skewer dipped in Marlene, extender, or turpentine. Blot the area dry with a tissue. Use a kneaded eraser to remove excess paint from prints treated with Pre-Color Spray.

6

Finishing the print

Air dry the colored print overnight. If you want to work color into a print that has been colored and dried, use extender or gel mixed into the new pigment. The addition of gel or extender makes a color lighter and more sheer.

Carefully remove the masking tape after you have completed the coloring.



© Doug and Mike Starn, *Yellow Horse and Rider,*
153 × 90 × 14 in., toner on orthomatic film, silicon and pipe clamps, 1990–1991.
The twin Starn brothers have been collaborating on artwork for over two decades. In this piece, they first applied Berg Golden Yellow toner to a photographic positive image printed on lith film. They employed clamps and bars to form scaffolding that holds the sheets of film in tension. The clamps force the film panel to bow out in simple arcs formed only by pressure. This visual, physical tension underscores the Starns' concern with their understanding of "anti-stasis," while the subject matter and materiality refer to the transformative aspects of the passage of time.

Chapter 3

Toning

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- Materials 51
- Toning the Entire Print 59
- Split Toning 59
- Selective Toning 60

Toning adds color to a silver-based image, such as a black-and-white photograph, enlargement emulsion print (see Chapter 13), Van Dyke brown print (see Chapter 8), or graphic arts film transparency (see Chapter 5) by immersion in, or the selective application of, chemical agents. This process can be performed in ordinary room light as an added step after the print has been completely processed and thoroughly washed. Time, temperature, age, dilution, and the type of darkroom chemicals used for processing the print, as well as the type of paper (silver bromide papers usually are cool blacks, while silver chloride papers are usually warmer blacks), will cause variations in color and often affect the finished appearance of each toned image. Therefore, consistency in the making of the original prints and toning afterward is imperative if uniform results are desired.

Three different groups of toners will be described in this chapter. The first group contains a number of toners that chemically change the silver in a print from black to various other colors. The second group, called *color coupler toners*, plate the silver with a color dye. The third group, *dye toners*, give a uniform color to both image and paper.

Toners in the first group convert silver into other insoluble substances, creating new colors in the image areas but leaving the paper unchanged. The colors you can obtain range from a slight brown, blue, or purple tinge to bright pink or reds. The more vibrant variations usually are produced by using the toners in conjunction with one another. The image alters in relation to its density (the amount of silver buildup or darkness); some solutions tone the highlights first, while others begin by coloring the print's shadows. *Split toning* takes advantage of this characteristic and is obtained by stopping the toning process prematurely, when the highlights and shadows are different colors. Some photographers use two different toners, one after another, creating one color in the highlights, another in the shadows, and sometimes obtaining a third color in the mid-tones. An added benefit of these toners is that the emulsion is protected from pollutants, so the life of the image is extended.

Color coupler toners also attach to the silver of the image and leave the paper base white, but they use dyes to obtain the final colors. Because they are not so dramatically affected by variations in chemistry, time, and temperature during the darkroom processing of the print, you can anticipate with some certainty exactly what color the toner will impart. The one drawback to this class of toners is that the dyes lack stability and can fade with prolonged exposure to light.

Dye toners color both the image and the base upon which it is printed. The result ranges from a light tint to a highly saturated color. These toners can be used alone or as an additional color in a print toned with one or more of the toners described above. You can tone the whole print, or color can be selectively added to the picture in a number of ways. Toners may be applied to specific areas with a brush or spray bottle, or parts of the print may be masked before the print is placed into the toning solution. As you work with the toners, you will quickly develop your own methods for controlling color across the surface of the print.

Safety

Before you start to work with any toner, thoroughly read the manufacturer's instructions, any precautions listed, and the safe-handling guidelines.

Most toners give off a disagreeable odor and some can, particularly in accidental combination with common darkroom chemicals, give off a toxic gas. Selenium, for instance, will emit toxic gases if concentrated acids (such as stop bath) contaminate it. Toning must be done in a well-ventilated room. Your work area must have at least ten complete changes of air per hour, and the exhaust must be pumped out of the building. Selenium toner and sulfide toners, such as Polytoner, should only be used under a local exhaust. Or, work outdoors.

In order to prevent any accidental mixing of chemicals on the print, thoroughly wash photos before toning.

Do not inhale any powdered chemicals. Wear an appropriate mask.

Always *add acids to water*, not water to acids.

Contact with the toners can cause allergic reactions, contact dermatitis, and even poisoning. Neoprene gloves must be worn, and the toning solution must be rinsed off immediately should you splash any on yourself. The toning solutions can permanently stain clothing.

Call your local poison center immediately should you ingest any of the toners.

Avoid toning during pregnancy.

When disposing the solutions used for toning, flush the sink basin and drain with water after pouring out each chemical. Selenium is considered a hazardous waste and should only be handled by a waste disposal company or by a local household waste program, usually available free or at minimal cost to noncommercial photographers. The equipment you use also can become stained, and, therefore, you might want to have a separate setup for toning. Commercially available tray cleaners may remove some of the stains, but thoroughly wash the trays and flush the sink and drain before you apply cleaners, or you may create cyanide gas fumes.

Method Overview

1. For selective toning, a mask can be applied to cover up part of the print.
2. Print is presoaked for at least 10 minutes (30 seconds for resin-coated paper).
3. Print is immersed in the toner, or toner is applied to selected areas.

4. Print is cleared, washed, and dried. Mask is removed.

5. For multiple toning, the clearing bath in step 4 is omitted, but the print is thoroughly washed, and steps 3 and 4 are repeated.

Materials

1. Image. Most conventional photographic papers will tone to some degree, but the most dramatic results will be obtained by using a chloride paper, such as Kodak's AZO (Photographers Formulary sells a paper, made by Michael Smith and Paula Chamlee—the name has not been decided as of the writing of this book, but it will be like the old Kodak AZ0—and Amidol developer for AZO), Centennial or Chicago Albumen Work's (no longer in Chicago nor manufacturing albumen paper!), Printing-Out Paper, or First Call Printing-Out Paper (in Europe). They produce warm brownish prints and take wonderfully to gold toner. Although not sensitive enough to use under an enlarger, they work well contact printed in ultraviolet light with the enlarged negatives or photograms described in this book (see Chapters 5 and 6). A special order item at your photo store, AZO paper comes in both single weight (500-sheet boxes, 2¾ × 4½ in., to 50-sheet boxes, 20 × 24 in.) and double weight (250-sheet boxes, 8 × 10 in. or 11 × 14 in.). The paper is boxed with a specific contrast grade, from 1 (low) to 4 (high). As of the writing of this book, Kodak announced that it will cease manufacturing black-and-white paper by 2006, so it is not clear what will happen with AZO Printing-Out Paper, available from Calumet (see Supply Sources), comes in a roll or in a 50-sheet package of glossy surface, double weight 8 × 10 in. or 11 × 14 in., along with its gold toner.

Liquid Enlargement Emulsions (see Chapter 13), Bergger, Prestige, and Silver Supreme Photo Paper, Forte Polywarmtone Plus FB, Kentmere Art Classic, Ilford Ilfobrom Galerie and Multigrade IV Deluxe, and Oriental Warm Tone Paper will tone well. Resin-coated (RC) papers can be toned, but they do not react in the same way as fiber-based papers, so refer to the instructions packaged with the toner before you start. Please note that Berg does make a special Sepia/RC toner that can be used on resin coated (RC) or fiber papers. RC paper cannot be left to soak; tone, wash, and dry each print separately. The printing process requires constant care so that the prints are not bent or cracked. You may benefit from making both test prints and finished prints of each image.

Different toners best serve photographs with different characteristics. For instance, Berg Brilliant Blue works best with a slightly light print, while Sepia, Green, and Copper/Red toners require one that is somewhat dark because it works on a bleaching and replacement method. Split tones, where the midtones partially change to a warm red-black from selenium, are best obtained by using moderately high-contrast negatives on a low-contrast grade of paper to render a print with a normal, but punchy, tonal range. If you presoak the photograph in very warm water before toning, use a fairly concentrated solution (1 part selenium to 7 parts or less water), and wash afterward in warm water, you sometimes can quicken and dramatize the effect. You will have to experiment to find the type of paper, contrast level, and tonal range that best works with the tendencies of the toner you have chosen.

The type of chemistry, time in the processing solutions, and temperature of the chemistry when making the original photograph will affect both the overall color and the intensity of a split in color.

Developers vary in hue, contrast, and tonal range, just as paper does. Any developer can be used with any photographic paper to yield results that you judge as more or less acceptable. Each combination will give a different result when toned; in addition, changing the dilution or temperature of the developer or fixer prior to processing the print will further influence the final effect of the toner on the print. Using fresh developer and fixer will help ensure a crisp, rather than muddy, print and keep the highlights clean after toning. To experiment with what kind of photograph your method works best on, make prints using two or three different exposures. All toned photographs look different when they dry, so keep notes on the back of the print of all the variables you employed. I tone one test picture at a time, partially blot dry the back of the photograph as I tone, and write information with a black permanent felt-tip marker.

To avoid mottling the paper base when you later tone the photo, use fresh stop bath at the recommended dilution for the proper amount of time. Always use two fixing baths, each for 5 minutes, in order to prevent the formation of compounds that can lead to staining and a less-permanent print (particularly apparent with blue toners). Fixers can be mixed to different strengths that will have some effect on color, but no matter what fixer or dilution you use, do not overfix the print. Fixer without hardener will result in a print that will tone more rapidly and evenly, with fuller tones, than prints hardened prior to toning. Three such fixers are Kodak Rapid Fix without the addition of the hardening solution in the B bottle (may not be available after 2006), Ilford II powder or Ilford Rapid Fix liquid, and hypo available from Photographers Formulary.

Adequate washing is imperative. Traces of fixer in the photo or print can cause uneven toning. The advisability of using Hypoclear or Fixer Remover before toning varies from toner to toner, so read the instructions packaged with the toner before you process the prints. I have been using Berg Bath™ after fixing and after each toning bath to keep the prints clean. If a tray or tray-and-siphon is used for the final wash, the prints must be constantly agitated to ensure that they are completely free of chemical residue. If you are not sure whether you fixed or washed enough, redo those steps.

Van Dyke brown prints (see Chapter 8) contain silver and can be toned. Proper sizing of the paper (as described in Chapter 4) can prevent an unevenly sized surface or fibrillation of silver nitrate in the fibers of the paper that might cause staining. Van Dyke brown prints can be toned prior to fixing; this process is described later in this section under "Formulary Gold Toner for the Printing-Out Process." In general, the toning process will affect the density of a Van Dyke brown print, so based on the information given previously for black-and-white paper, start with an image that is either lighter or darker than normal.

2. Toners. Some of the toners that convert silver to other substances are as follows: Kodak, Fotospeed or MACO Selenium Toner, Sepia Redevelopment Toner, and Poly-Toner (again, Kodak may discontinue manufacturing these items); Photographer's Formulary Gold Toner 231; Berg Copper Brown, Protective Gold, Brilliant Blue, and Yellow Toners; and Rockland Halo Chrome Toner. As you begin to investigate toning, these prepackaged products, which can be purchased at photo stores, allow you to try a wide range of colors.



Elaine O'Neil, *British Museum, London, England,* **18 × 12 inches, Sepia toned Kodak Polyfiber—two bleach method, © 1977.**



Elaine O'Neil, *North Yorkshire, England,* **18 × 12 inches, Sepia toned Kodak Polyfiber paper—two bleach method, © 1977.**

If you decide on a specific paper and toner combination, you may wish to mix toners from raw chemicals to save money. Formulas appear in many photographic publications, including *The Photo Lab Index* (Dobbs Ferry, NY: Morgan and Morgan) and *Processing Chemicals and Formulas for Black-and-White Photography* (Kodak professional data book, number J-1) and the website for Photographer's Formulary (see Supply Sources) where you also can purchase the components. If you are unfamiliar with mixing raw chemicals, learn about safe handling and mixing techniques before you start to work.

Treat enlargement emulsion prints (Chapter 13) just as you would conventional prints, but remember that the surface may be more delicate, so extra care must be taken to avoid damaging the emulsion—I actually use hardener in the fixers and take that factor into account when I tone.

To start, read the instructions packaged with a given toner, tone a print that way, and then begin your variations. Also, do not exceed the capacity listed in the instructions for the toner you have chosen. Know that the print usually continues to tone in the wash water, so remove it from the toner before it becomes the color you want.

The following general guidelines tell you what to expect when a specific toner is used on a photograph, an enlargement emulsion print, or a Van Dyke brown print. These are suggestions for where to begin experimentation, and are not to be taken as a complete list of possibilities:

Selenium Toner doubles the lifespan of your photo and deepens the blacks if used for a short time, or turns a print purple-black if left to soak for an extended period. I tend to use it last because it is so strong. Some papers, such as the ones mentioned above, will split, with the shadows and midtones turning reddish brown and the highlights remaining silvery gray. For a tone change, dilute 1 part toner with 3 to 19 parts of water; if split tones are desired, try a dilution of 1:7 to start. Toning should occur in 2–8 minutes at 68°F (20°C). Do not heat the toner, as some practitioners suggest, because a toxic fume is released.

Selenium toner will increase the contrast of a Van Dyke brown print and change its color to a purplish brown. It is best used between the development and fix steps during processing (as described in "Formulary Gold Toner for the Printing-Out Process," below) or after the fixing has taken place. Try a dilution of at least 1:20, and watch the print carefully as toning occurs rapidly and pales the print.

Sepia Redevelopment Toner will impart a yellow-brown color to the image. This toner requires the use of a bleach bath to prepare the silver in the print to accept the toner, and only the silver that has been affected by the bleach will change color. Because the bleach attacks the highlights first, the length of time in the bleach bath can be varied to achieve results ranging from a warm brown/cold black split (by using the bleach for 10 to 20 seconds before toning) to a completely pinkish brown-and-white print (by bleaching until the image disappears before toning). Because sepia works quickly, I sometimes change the dilution of the bleach beyond the manufacturer's recommendations so that the highlights and midtones are bleached out in less than 5 minutes. Then I wash and examine the print before toning it.

The print may be partially bleached again after the toning bath, carefully washed, and toned in another color, such as Gold 231. Or the bleach alone with no subsequent toning bath may be used



Elaine O'Neil, *Li River, China,* **16 × 23 inches, Sepia toned Kodak Elete paper—two bleach method, © 1987.**



Elaine O'Neil, *Spring Festival Photo Booth, Lidui Park, Guanxian, China,* **16 × 23 inches, Polytoned (dilution 1:32) Kodak Elite paper, © 1987.**

to alter the look of a print. In either case, after bleaching, all traces of yellow must be washed away, and the print should be fixed and washed for the time recommended by the manufacturer.

Mix the toner and bleach according to the directions on the package, and take care not to contaminate the two solutions with one other.

Kodak Poly-Toner has been discontinued, but Photographer's Formulary Polysulfide Toner is similar and quite economical. It renders colors that range from the cold black of selenium through the warm brown of sepia, and past that to orange. A simple chart on the Formulary website (see Supply Sources) shows how to dilute the toner and amount of time needed to produce the color wanted.

After Van Dyke brown prints have been fixed, they can be Poly-Toned to reduce contrast and shift the color to a warm yellow-brown. When making the print, give it extra exposure to compensate for the bleaching action of the toner.

Photographers' Formulary Toner 231 and Berg Protective Gold Toner will produce rich blue-blacks in a previously untoned print or can be used after sepia toning to get brilliant reds or split tones. Be sure to wash the print thoroughly and, to conserve the gold in the toner, cut away any excess exposed print area prior to toning. The formula and instructions for Gold 231 can be found in the Photo Lab Index; instructions for Berg Protective Gold Toner are included in the package.

Formulary Gold Toner for the Printing-Out Process is an excellent toner for increasing the contrast and intensifying the shadow areas of a Van Dyke brown print when used before the print is fixed. It can be mail-ordered from the Photographers' Formulary and Chicago Albumen Works (see Supply Sources) and includes mixing instructions. After exposure, rinse the print until the water is clear rather than milky, trim the edges of the print to conserve the gold, and place the print in the toner. Watch for a split in tones between the highlights and shadows, pull the print from the toner, then fix and wash as usual.

Berg Copper Brown, Tetenal Copper, and Spedibrew's (powder) Copper Toners (the last two are available through Silverprint, listed in the Supply Sources) produce a very different color, much more reddish brown than sepia. When nonhardening fixer is used to process the photograph, the image will turn completely brown, but when a hardening fixing bath is used it will split to copper shadows and grey highlights, particularly when Ilford paper is used. Mix and use according to the instructions packaged with the toner, but for split tones you may want to remove the print from the toner prematurely, because it continues to tone as it washes. If you have a problem with pink staining on the print, some photographers recommend adding a few grams of potassium citrate to the solution. Mixing from powders requires safety precautions, such as goggles and a mask. See blue toners, next, about reversing the color.

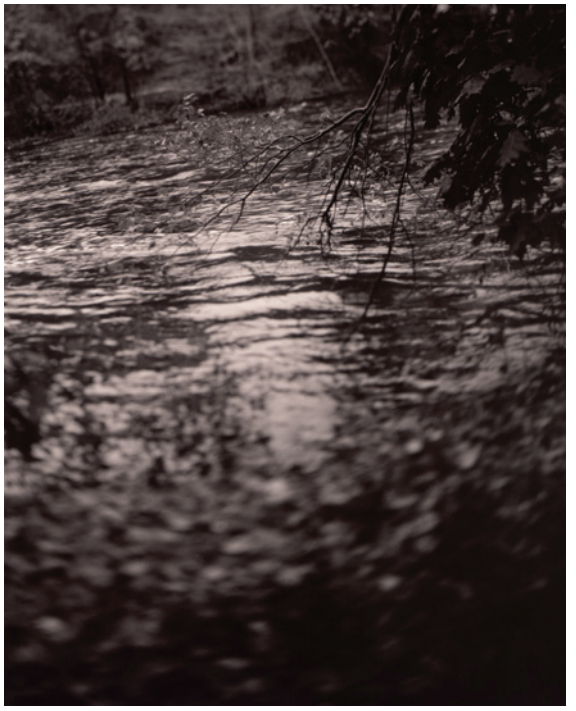
Berg Brilliant Blue, Tetenal Blue, Spedibrew's (powder) Blue and Prussian Blue, and Porcelain Blue Toners, which will give you a bright blue image equal in intensity to a cyanotype, works best with a print that is lighter than normal. (Actually, many blue toners are made from 1 part cyanotype A and a bit more than 1 part cyanotype B, as described in Chapter 7, 60 parts water, and 7 parts 28% acetic acid.) Use according to the directions packaged with the toner.



Elaine O'Neil, *Jerusalem, Israel,* 4 × 5 inches, untoned Van Dyke Brown print, 1983.



Elaine O'Neil, Gold toned Van Dyke Brown print showing shift in tone and increased contrast.



Laura Bernier, *Untitled*, 4 × 5 inches, Gold Toned Printing-Out Paper from color negative, 45 minutes exposure, 2006.



Laura Bernier, *Untitled,* 4 × 5 inches, Gold Toned Printing-Out Paper from color negative, 20 minutes exposure, 2006.

A solution of black-and-white photographic paper developer diluted three or even more times more than the manufacturer recommends will reverse the effect of either copper or brilliant blue toner, and I suggest 1 part developer to 20 parts of water so that the redevelopment is slower and you can pull the print for a partially toned effect, or wash it and put it in another toner. If the photograph or a Van Dyke brown print is immersed in the solution until it reverts to its pretoned appearance, the print can be selectively redeveloped by coating the area to remain unchanged with a masking agent before immersion. The mask is removed after the print has been washed and dried. In addition, you can brush developer onto chosen areas.

Rockland Halo Chrome converts the photographic image to a metallic silver-and-white or black-on-silver. Specific instructions are packaged with the toner. Combine it with dye toners, described below, to produce silver-on-color pictures. It is not recommended for use on enlargement emulsion prints.

Color Coupler Toners include Edwal Color Toners, the Berg and Fotospeed Color Toning Systems, and Rockland Selectchrome.

Edwal Color Toners come in red, yellow, blue, green, and brown. Before use, the toners may be mixed together to make new colors, except for the blue toner, which must not be mixed with any other color. Another way to achieve intermediate colors is to use the toners one after the other, allowing each new toner to change the color of the previous toning layer. To avoid contaminating one color with another, be sure to wash the print well between toning baths. In the darkroom before toning, a fixer clearing agent should be used to ensure that the prints are completely free of fixer. Dilute the toners according to the directions, and use immediately.

Rockland Polytoner and *Berg Color Toning System* (not to be confused with the previously described Berg toners) also come in a wide range of colors and can be used like the Edwal Toners described above. One advantage the Berg system has over the Edwal Toners is that the Berg is packaged with an activator that helps prevent color from appearing in the white areas of the print. Berg includes a clearing solution and colors can be reversed. Recently, Juliana Swatko, author of Alternative Color Photography (Chapter 15), informed me of the Color Viv system, which is liquid toners that you can mix in varying proportions in order to produce blue, green, yellow, orange, and some split-colored results like blue-green or and yellow-green. With the addition of another bath, using the dye color, you can create red and violet. The final step is a fixing bath made with table salt and water (also the method used for dying fabrics). Unfortunately, their website is only in French and Color Viv does not provide contents or health warnings. Swatko says that the product must have potassium ferricyanide (one of the cyanotype components and a silver bleach) because she can obtain a chemical solarization of the image.

Dye toners include the Rockland Printint Colorants and Fotospeed Antique Dye. Printint comes in red, yellow, and blue and can be mixed to make other colors. Both Printint and Antique dye stain the paper. They can be used as a bath to tone the entire print or can be applied with a brush, but they may not be suitable for selective toning using a masking agent because only the image area is protected. This leaves the paper base susceptible to the action of the toner. You do not wash the print after using these products.

All these toners can be used separately or sequentially, but the silver-converting toners are most effective in the following order: sepia, poly, copper, selenium, gold. They should be used before toners from the color coupler group, and either group should be used prior to the dye toners. My students have created greens in midtones by using sepia or Berg Golden Yellow first, then Berg Blue. We have gotten purples from Berg copper before blue. Ilford and Fotospeed additionally suggest that sepia and then selenium produce brown purples, selenium and then gold produce purplish blue midtones, and blue before selenium creates blue shadows and buff highlights. The print must be thoroughly washed between toning baths to prevent the contamination of one toner with another.

3. Trays. You will need at least three trays: one for holding wet prints prior to toning, one for the toning solution, and one for washing the print after toning. You may need more trays for other toners, print developer, or stop bath. Prints toned in different toners cannot be washed in the same tray, as the toners will migrate from print to print.

The trays must be made of glass, plastic, or enamel and bear no chips or cracks. Metal trays will react to the toning solution and should be avoided. Dish pans can be substituted for photographic trays, but obviously they never can be used in the kitchen again. In order to avoid uneven toning, the tray must be large enough to accommodate the entire print. The trays often get stained by the toners and can contaminate prints. These stains can be removed using commercial tray cleaners after all traces of toner have been washed away and the drain has been flushed with water.

4. Masking/Frisket Material. Many art supply companies, such as Winsor and Newton, Speedball, Grafix, Dr. Martin's/Salis, Fotospeed, Luma Liquid Mask, or Photo Maskoid Liquid Frisket™ make good products that can be used to mask areas of a dry print before toning and are easily removed when the print has dried. I like the Grafix White Mask Liquid and Luma (white) Liquid Mask because they can be seen once they are put on a print. Photo Maskoid Liquid Frisket™ is available at some fine-art stores, and all graphic arts supply stores. Be sure to get transparent red, not the red opaque type. Its red color makes it easy to see exactly which sections of the print have been covered, and its consistency aids in the control of detailed areas.

Rubber cement is readily available and inexpensive. However, it is transparent and difficult to see while being applied. It also has a consistency difficult to control. These disadvantages abound when one is trying to mask in a precise and detailed manner. To overcome these problems, mix equal parts of acid-free rubber cement and rubber cement thinner with a few drops of red food coloring prior to use. Thinner is also useful for cleaning the brush/applicator.

For more precise masking, use a 000 (triple zero) brush and magnifying glass or desk lamp. Wash the brush immediately afterward, as masking fluid dries quickly. Winsor and Newton suggests soap and water wash up.

5. Applicators. Inexpensive watercolor brushes, cotton swabs, or sponges can be used to apply a mask to the print prior to toning and to prepare selective areas to tone. Because brushes may be ruined during these processes, use cheap ones. If you are going to use a brush with a metal ferrule to selectively apply toner, coat the ferrule with rubber cement beforehand as a protective measure. Japanese Bamboo Sumi and Hake painting brushes are excellent because they do not have a metal band, but Hake brushes can be somewhat expensive.

6. Water. Running water near the toning area is required for presoaking and washing the print and for the immediate removal of any splashes or spills. Because impurities and high mineral content in tap water may prevent prints from toning evenly, distilled water is helpful when mixing toner chemistry.

In addition, some photographers presoak their prints in a solution of 1 tablespoon balanced alkali and 32 oz (1 L) distilled water, rather than plain tap water, because they claim that the photo paper accepts the toner better when it is a neutral acidity. Wear a respirator with toxic dust filter, gloves, and goggles when mixing the powder and keep your hands and eyes protected when using the solution. Do not ingest.

7. Vapor mask and protective gear. When mixing powders, such as certain toners or balanced alkali, you will need a toxic dust filter on the mask, goggles, and gloves.

8. Miscellaneous. 16 oz (500 ml) or larger non-metallic graduates and mixing rods, bamboo or plastic tongs, a sheet of glass with sanded edges to rest the print on when selectively applying toner, a print squeegee, a darkroom thermometer, a tray siphon or print washer from a photography store, and brown bottles to hold 32 oz (1 L) or more fluid. You will need paper towels to blot the back of the print so that you can write notes on your technique with a marker pen or pencil.

Tips

- Some commercially-made photos do not contain any silver and cannot be toned.

- As indicated in the Materials section, not all toners are suitable for each of the three methods listed above; therefore, first use a test print to check the activity of the toner and the final color. If you like the result, repeat exactly what you did with the test print. Notes that itemize all the steps a particular print has been through should be made on the back of each print using a permanent marker such as a Sharpie.

- It is often helpful to place a wet, untoned print, made on the same paper as the prints to be toned, next to the tray of toner. Because the action of some toners will not be apparent until change is radical, the use of a comparison print will help you to see subtle changes in color.

- To eliminate the green tint from the black in a black-and-white photograph, to double the lifespan of your photograph, and to clean up the highlights, dissolve 1 part liquid selenium toner in 11 parts Heico Perma-wash™ or other fixer remover. After exposing and processing the photograph as you do normally (using a fixer without hardener for at least 3 minutes), quickly transfer one print at a time to a tray of toner and Perma-wash™. With constant agitation and under good lighting, tone the print until the whites clear up and the blacks turn purplish. Pull the photograph out, place it in a tray of wash water, and wash normally.

- You can tint (change the color of the image and the paper substrate) with medicinal and food colors. The skin of Bermuda onions, after boiling in water, make a purple liquid; regular onions treated similarly and brewed coffee or tea yield browns. After any of these tinting liquids have cooled to room temperature, pour the fluid in a photo tray and immerse your photograph with gentle agitation until you achieve the desired color. A few drops of iodine in water make a yellow tinting agent, while mercurochrome handled in the same way produces red.

- Persistent yellow stains can be removed in a properly washed blue-toned print. Make a tray of 1 tablespoon table salt diluted in 1 qt (1 L) water and pass the print quickly through it or use a cotton swab soaked in this solution in the effected areas. Rinse the whole print again. Manufacturers also advise an 80% solution of acetic acid on a cotton ball to remove residue scum and then rinse after.

- Kentmere and Arista manufacture double-weight, black-and-white fiber paper in rolls, which is handled normally in the darkroom. After the image is dry, it can be torn, toned, or drawn onto with artists' colored pencils (see Chapter 2) and other media. Kodak stopped making mural paper in 1987.

Toning the Entire Print



1



Presoaking and toning

Place all the prints, one at a time, in a tray of room temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak, and squeegee the front. Immerse it, image side up, in the tray of toner, while constantly rocking the tray gently to help ensure even toning. Remove the print when the color is a little less intense than desired. With blue toners, tone past the point you want to be and wash the print back. Prolonged washing will regenerate the blue tone to black-and-white, which can be very effective for getting a really clean, crisp blue tone.



2



Washing

Wash the print for at least 20 minutes (for resin-coated prints, 2–4 minutes) in rapidly changing 68°F (20°C) water. The prints must not touch while washing, or stains may develop. Handle the print carefully, as toning often softens the emulsion, making it susceptible to damage. Step 1 can be repeated using the same or different toners. Be sure the print is thoroughly washed before it is placed in a new toner.

Split Toning



1



Presoaking and toning

Place all the prints, one at a time, in a tray of room-temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak, and squeegee the front. Keep a wet, untoned print next to the tray of toner to determine, by comparison, when to stop toning (probably 25% less time than you would use for toning the entire print). Immerse the print in the toning bath and pull it out as soon as the shadow or highlight areas, depending on the type of toner, start shifting color.

You can either stop at this point or wash the print and immerse it in a second tray of a different color toner until you see the hues you want. With Berg toners, you can deliberately overtone in the first toner, immerse the print in developer and stop bath, and then pick another toner color to replace the black areas you have redeveloped.

2



Washing

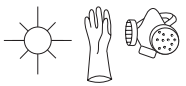
(See illustration for step 2 of Toning the Entire Print.)

Wash the print for at least 20 minutes (resin-coated prints, 2–4 minutes) in rapidly changing water. The prints must not touch while washing, or stains can develop. Handle the print carefully, as toning often softens the emulsion and makes it susceptible to damage. Some toners, such as selenium, will intensify while being washed, so do not judge the print until it is completely washed and dried. Dry using a blotter roll or on screens with the image face up.

Selective Toning



1



Masking the print

Thoroughly coat the areas that are to remain untoned with a generous amount of rubber cement or masking liquid. Any small spots that are missed will tone and will be obvious in the final print. Allow the mask to dry completely.

2



Presoaking and toning

(See illustration for step 1 of Toning the Entire Print.)

Place the prints, one at a time, in a tray of room-temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak and immerse it, image side up, in the tray of toner, while constantly rocking the tray gently. Avoid extremely long toning times, when toner might seep under the mask.

3



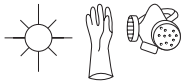
Washing

(See illustration for step 2 of Toning the Entire Print.)

Thoroughly and carefully wash the print for at least 20 minutes (resin-coated prints, 2–4 minutes) in rapidly changing water. Prints must not touch while they are washing or stains may develop. Handle the print carefully because toning often softens the emulsion, making it susceptible to damage. Air dry face up.



4



Removing the mask and optional retoning

When the print is thoroughly dry, use celluloid tape on a corner or carefully rub the surface of the print to peel the mask. If desired, the print could be masked again, the untoned areas of the print split-toned, or the entire print placed in a different toning bath.

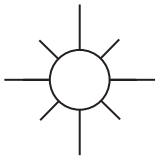
Part II

Preparation for Light-Sensitive Methods

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5 Making Negatives: Analogue Method 86

6 Making Negatives: Digital Method, by Youngsuk Suh 120



Daylight



Subdued Light



Safelight



Protective Gloves



Respirator



Protective Goggles



Laura Blacklow, *Journal*, 36 × 58 inches. Electrographics and pastel, 1989.
Before inkjet printing was common, I made a black-and-white photograph, which was blown up on a huge photocopier used for enlarging architectural drawings. Afterwards, I applied pastels. www.lblacklow.com

Chapter 4

Creating the Photo-Printmaking Studio

- Equipment 63
  - The Light Box
  - The Contact Printing Frame
  - The Exposure Unit
- Materials and Procedures 75
  - Materials
  - Supports
  - Sizing
  - Handling Thin Papers

EQUIPMENT

Many of the printmaking processes described in Part III, Light-Sensitive Methods, are accomplished without a photographic darkroom or film-developing area, although an artist may want access to a darkroom (see Chapter 5) or a computer and printer (see Chapter 6) for making large negatives. Cyanotype, Van Dyke brown, gum bichromate, casein pigment, palladium, and Kwik Print[1] emulsions are applied to paper or fabric in subdued daylight, dried, exposed to bright ultraviolet light under black-and-white contact-size transparencies, and developed. A *light box* for viewing negatives, a *contact printing frame* for holding negatives in place against the photo-printmaking emulsion, and an *exposure unit* of ultraviolet light, all become indispensable once you start using them. This chapter shows how to build these items easily and relatively inexpensively. Please note that technical information on choosing and sizing paper, registering negatives, and utilizing graphic arts aids is in the Materials and Procedures section beginning on page 75 of this chapter.

The Light Box

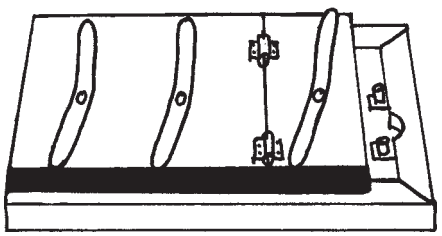
Most graphic arts and photography stores sell light boxes for viewing and touching up transparencies and for cutting and taping them into masking sheets. If you buy one, make sure it has a glass top or buy a sheet of glass to fit on top, so that when you cut masking sheets and negatives with a stencil knife you will not scratch the opal Plexiglas™ or white plastic viewing surface. *Build Your Own Home Darkroom* (see Duran and McDonald in Bibliography), describes detailed instructions for making a high-quality light box at about one-third the cost of purchasing one.

You can create a simple light-viewing system with a desk lamp, storm window, velum, and three chairs. Just set up a gooseneck lamp on a floor so that the light bulb faces upward. Using clear cellophane tape, attach a sheet of tracing paper or drafting vellum to one side of an old storm

[1] Please note that Kwik Print has not been manufactured since 2000, but a previous chapter I wrote about is on the Focal Press website.

window. Use three chairs of equal height, placing two on either side of the lamp and one behind it. Lay the storm window, glass side up and vellum side down, securely on the chair seats. Make sure that the lamp is far enough away from the paper or vellum (used to diffuse the light) that it does not overheat.

The Contact Printing Frame



An altered contact printing unit showing registration buttons inside frame.

Whether creating multicolored images or monochrome pictures, you will need a way to hold the negative in strict contact with the photo-printmaking emulsion during the exposure. If the negative is not tightly touching the emulsion, a blurry or double-exposed image might result, causing problems in the readability of the image. If you like blurry images, however, you have more control if the negative itself is out of focus.

You can buy a contact printing frame at a photography store, usually as a special-order item. Common, useful ones are made by Photographer's Formulary and Bostick & Sullivan (see Supply Sources). You might find a bargain-priced contact frame at a flea market or online; after all, the originators of these photo-printmaking processes made their exposures in sunlight with a contact printing frame, as illustrated on page 168 and 169, "Panorama of Talbot's Reading Establishment." The frame, which usually comes in standard photographic paper sizes such as 8 × 10 in. (20.25 × 25.5 cm), 11 × 14 in. (28 × 35.5 cm), and 16 × 20 in. (40.5 × 50.75 cm), is a piece of glass surrounded by wood for the top and a hinged two-piece wood bottom lined with felt or foam. Spring clips on the back slip under the frame to lock it, thus securing the contact between emulsion and negative, sandwiched inside. One of the spring clips can be released during the exposure without disturbing the position of the negative, part of the bottom can be opened at the hinge, and the emulsion/image can be checked. This feature is particularly helpful with cyanotype and Van Dyke brown printing, where exposure time is based on a visible change of the emulsion's color.

If you intend to use a registration system for lining up negatives when creating multicolored prints, you need to buy a frame one size larger than the print size in order to accommodate the registration pins and masking sheets. To avoid breaking the glass when you close the frame, you will also need to saw off about ½ in. (1.25 cm) from the wood back and tape the registration pins onto the glass at this margin.

An alternative to buying a contact frame is making one, quickly and for one-third the price.

Safety

To lessen the risk of cuts when you handle sheet glass, either have the glass beveled or sanded or use heavy tape to cover all edges. Be aware that tape will block light during an exposure.

Materials

1. Registration pins. Registration pins are metal buttons mounted on thin sheets of steel. They can be purchased at graphic arts and printing supply stores. The height of the buttons varies from 3/64 in.

(1.75 mm) to ⅜ in. (1.5 mm); diameters usually are ¼ in. (9.75 mm). You will need at least four pins, which must match the diameter of the hole punch listed next. Two to three registration pins must be mounted on a light table for lining up and punching holes in the negatives or masking sheets, and two to three more are needed on the contact printing frame. More about registering the negatives on a light table is explained on page 76 of this chapter, and page 198 of Chapter 6.

2. Registration hole punch. For images 11 × 14 in. (28 × 35.5 cm) or smaller, you need to purchase an inexpensive two-hole punch at an office or offset printing supply store; larger negatives require a three-hole punch. Make sure that the punch creates holes with a diameter to match the diameter of your registration pins, usually ¼ in. or 9.75 mm. I use an Acco, model 74101, which I purchased at a stationery store.

3. Masonite, pressed wood, or plate glass. The board, which becomes the backing, should be at least 1½ in. (3.75 cm) longer and 1½ in. wider than the sheets of paper on which you print because you need extra space for the registration pins. Make sure the board is not warped. Richard Sullivan suggests using plate glass instead of board (*Labnotes,* p. 9; see Annotated Bibliography), and I concur. I have used plate glass for years.

If you use perforated hardboard from a lumber yard, you could build a Plexiglas™ box to go over it, attach the hose from a vacuum cleaner, and you would have a vacuum pin registration board that will not allow paper to move even slightly. Or, you could attach the pins to a sheet of glass with silicon cement to create a transmission pin registration board.

4. Glass. A sheet of plate glass, although expensive, is worth the extra investment because it really weights the negative down. Hardware store window glass, which is ¼ in. (9.75 mm) thick, will do as a distant second choice, or a discarded storm window can be recycled. The glass should be slightly larger than the printing paper. Make sure the glass is not the kind that blocks ultraviolet light.

5. Tape. You will need 1½ in. (3.75 cm) wide cloth or duct tape for two purposes: adhering the registration pins and hinging the glass. You may also need it for masking the sharp edges of the glass.

6. Foam rubber or polyurethane foam (optional). For extra "give" when the glass presses down on the negative and to create stricter contact between the negative and the emulsion, a sheet of absolutely consistently ⅛ in. (5 mm) thick foam, a sponge rubber pad such as the type used for an area rug, or felt can be attached to the board with glue. It should be the same size as and line up with the glass. If you use this foam backing, buy registration pins taller than ⅛ in.

I have discarded the foam I used to use, because I found that eventually it became worn down in different areas, so the strict contact was compromised.

7. Index card stock or scrap sheet film. You will need a sheet the same length as your hole punch.

8. Marker. A red ball-point pen, permanent felt tip marker, or lithographic red pen sold in graphic art stores is necessary.

Tips

■ If you have taped around the edge of the glass to prevent cutting your hands, the tape will block light during the exposure and result in a border on printing paper.

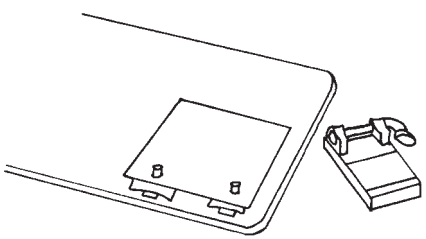
■ If you want to work to the edge of the paper, you will need to tape your negatives to hole-punched masking sheets or clear sheets of cellophane, as explained on page 76. You can buy inexpensive, reusable registration tabs from a commercial printing supplier or graphic arts store. Attach them to the board with durable tape so that the edges of the printing paper fit underneath. Be careful not to move them while you work. Other tabs can be made from photo corners or shirtboard folded and taped into the shape of photo corners.

■ The Premier frame I used to use and the one at the school where I teach need an extra layer of felt to promote tight contact printing. You can replace broken glass with nonultra-violet protecting window glass from a hardware store. Premier frames are sold by Freestyle Photographic Supplies, but this felt layer is good to keep in mind with other setups.

■ Another less stable, but usable, frame can be made simply with heavy bulldog clips from a hardware store, window glass and a Masonite backing.

■ To make a printing frame for fabric, I use canvas stretchers or plastic embroidery hoops. I pull and attach the fabric backward; that is, the "good" side of the fabric faces toward the back of the stretchers, creating a basin in which the negative and the glass can fit. In addition, I coat the stretched fabric with a foam brush. This method conserves the amount of emulsion needed because I can coat with the frame standing up, rather than lying on a table covered with scrap paper that absorbs much of the emulsion. See page 163 for photographs of this method.

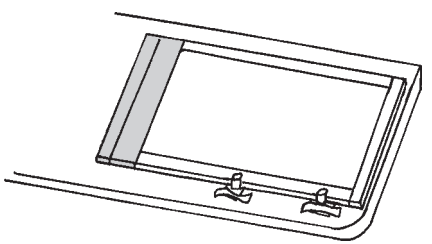
Making a Contact Printing Frame



1

Attaching registration pins

Insert index stock to the far inside edge guide of the hole punch, and make a set of holes in it. Relocate the index stock on the piece of Masonite so that holes are close to the board's edge on the lower half of the board. Insert registration pins through the holes from the underside and tape them to the board.



2

Attaching the glass

Remove the index stock. Place the glass so that one of its edges abuts the registration pins. The edge of the glass that is at a right angle to the registration pins and near the edge of the board should be lined up with the board. Using a strip of strong tape, hinge the glass to the board on the opposite side.

The Exposure Unit

Graphic arts and printers' suppliers sell plate makers, which are a contact printing frame and exposure unit combined. They are terrific for photo-printmaking but extremely expensive. If you do buy one, make sure that if the light source is carbon arc, which gives off dangerous fumes, it is thoroughly vented. NuArc and Edwards Engineered Products manufacture excellent exposure units.

An inexpensive exposure unit can be made by hanging a reflector with a sun lamp bulb (not a red infrared bulb), a 500-watt or 1000-watt photoflood bulb approximately 15 in. (38.1 cm) to 30 in. (76.25 cm) above the photo print. Using a 750- to 1000-watt quartz light bought at a professional photography store is more expensive, but more efficient. Be careful not to look at the bulb when it is on, or you will damage your eyes, so always wear ultraviolet protective goggles. The problem with these methods is that the exposure times are long, and if you bring the light closer you must check to make sure that the glass on the print frame does not overheat and crack and that the exposure area is as large as the image area.

Sunlight is the least expensive method, and it is splendid for cyanotypes and Van Dyke brown prints, where you can watch the emulsion change color until it is "cooked." Unfortunately, for critical techniques, such as casein, gum, and Kwik printing, or an expensive emulsion, such as Palladium, sunlight is not dependable year round and is not consistent throughout a day, making for varying exposure times even with the same emulsion.

I have found that building an exposure unit with black light fluorescent tubes is well worth the investment. Although relatively inexpensive (under $350 in U.S. dollars) given access to tools, the labor can be as intensive as four to eight hours. Please note that you can purchase a kit with almost all the requisite precut components from Edwards Engineered Products, listed in Supply Sources. As you probably know from most experiences in life, there is a trade-off: the kit is ready to assemble but is more expensive than gathering your own materials as described below.

The following instructions are for making a unit that will expose an area up to standard print-making paper 26 × 40 in. (66 × 101.5 cm). They can be adapted for larger or smaller images if you remember that each fluorescent tube will expose a 4 in. (10 cm) width when placed 6 in. (15.25 cm) above the printing frame, and if you make sure the fixtures remain approximately 2¼ in. (5.75 cm) apart. Light fixtures and tubes come in different lengths, but make sure that they are around 6 in. away from the emulsion, or you can see streaks that look like the tubes in the finished print. If one of the bulbs is out, you get an unexposed strip where that bulb was supposed to shine.

Following the advice of the former Palladio Co., I have mounted a 115-volt, 100 cubic feet per minute (CFM), 4 11/16 in. axial fan through a hole cut in the back of my fluorescent light unit and wired it to the on/off switch already on the unit because the bulbs heat up as they are used. Once they surpass 100°F (38°C), they give off less light, demanding an increase in exposure time, which in turn means the bulbs burn longer and heat up more. In addition, I cut an air cooling slot on the end wood piece as advised by Dick Sullivan and Carl Weese in *The New Platinum Print* (see Annotated

Bibliography). The slot is close to, but not against, a wall, so I do not look at ultraviolet light when the unit is on. An alternative approach would be to drill 1 in. (2.5 cm) holes on each side of the unit and put foam or a vent over each one, so that air, but not light, passes through. Either system works well with the axial fan, so that warm air, but not light, passes out.

Safety

Never purposely break a fluorescent tube—it contains poisonous metals, and the glass can cut.

Do not connect other electrical appliances on the same socket as the exposure unit.

Electrical work can be dangerous if approached incorrectly. Instructions in this book are intended as a guide so that you can discuss the job with an expert. All installations should adhere to local codes.

Although the information in this book is as near to complete as possible at the time of publication, the publisher and author cannot assume liability for any changes, errors, or omissions leading to problems you may encounter.

Make sure you read the following Tips section on page 70 *before* you start.

Materials

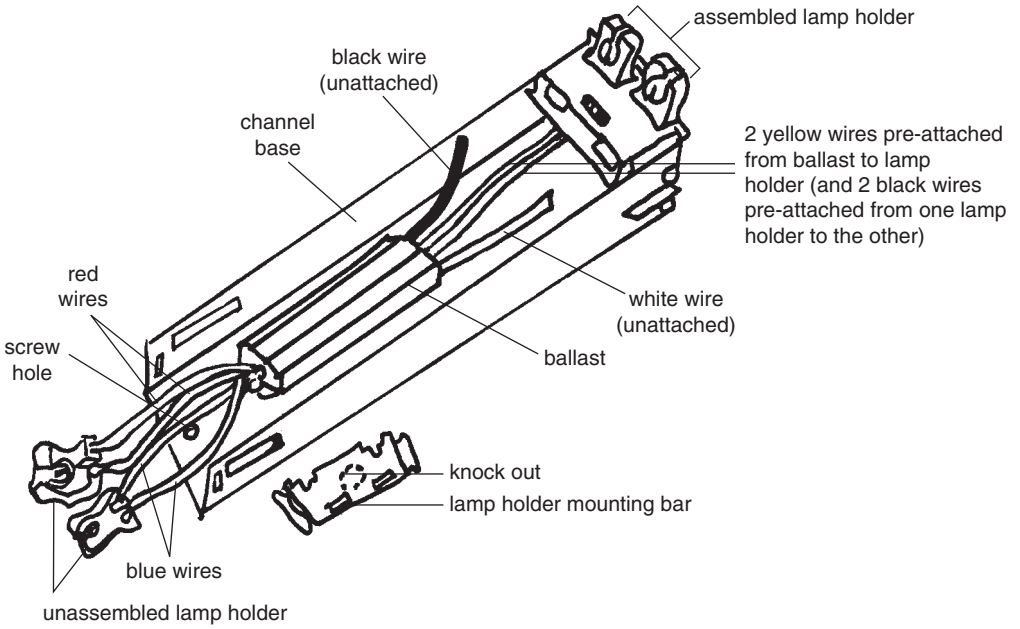
1. Tools. You will need a metal tape measure or yard/meter stick; pencil; hand-saw, jigsaw or skill saw; drill and 1/16 in. (2.5 mm) drill bit; Phillips-head screwdriver; hammer; sharp utility knife or wire stripper; wire cutter; pliers; small-slotted screwdriver; and a T-square or combination square.

2. Wood. One 10 ft. (3 m) length of 1 × 10 in. (2.5 × 25.5 cm) #2 common pine board will be cut to two 31¼ in. (79.5 cm) lengths and one 42 in. (106.75 cm) length to make legs. A sheet of 32 × 42 in. (81.25 × 106.75 cm) plywood ½ in. (1.25 cm) thick is used to build the top. When you go to the lumber yard, you can have them cut the 1 × 10 board and the plywood. Insist that the grain of the plywood matches the direction of the 42 in. length. Otherwise, the weight of the bulbs and fixtures will eventually cause the wood to sag.

3. Fluorescent tubes. Buy twelve 24 in. (61 cm) black light fluorescent tubes, labeled F20T12/BL by General Electric or Sylvania, available at an electrical supplier. They are a specialty item and should not be confused with black-light blue plant grow lights. Dick Arentz (*Platinum & Palladium Printing*, see Annotated Bibliography) recommends SA (Super Actinic), which are stronger but slightly more contrasty according to Judy Seigel (editor of the former *Post Factory Photography*), and AQA (Aquarium) tubes as more efficient.

4. Fluorescent strip fixtures. Buy six two-lamp 24 in. (61 cm) rapid- or trigger-start strip fixtures at an electrical supplier. A fluorescent fixture comes partially assembled with a U-shaped channel base, which includes the boxlike ballast, wires, and two lamp holders. You also get two sets of parts: mounting bars for the lamp holders and fixture end pieces, and a flatter top of the same metal and length and width as the base.

On a sturdy table, place the base so that the ballast and wires face up. Stretch the lamp holders and wire to each end of the fixture to which they are nearest. The lamp holder mounting bar then clips

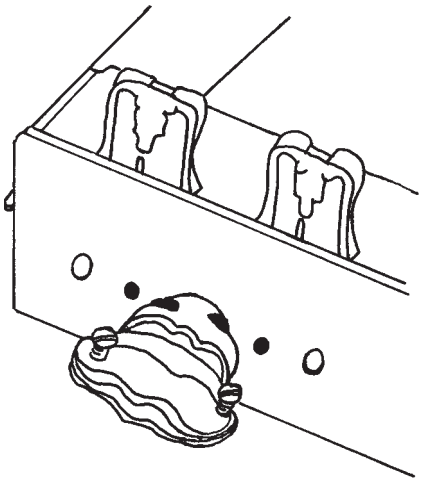


Partially assembled strip fixture.

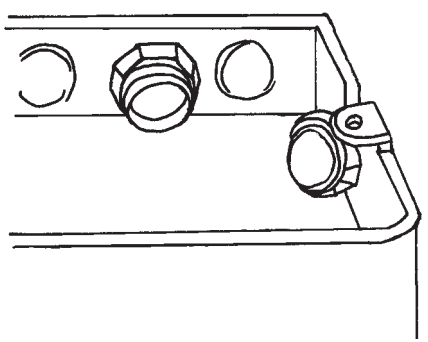
or bolts onto the slots on either side of the base near the end. Spread the sides of the base and insert the leg of the mounting bar so that the two cutout parts face out and the top of the mounting bar is flush with the height of the sides of the base. The lamp holders slide into the cutout parts with the flat side flush to the end and with the holders secure and perpendicular to the base. These lamp holders will hold the fluorescent tubes. (Some fixtures come with the lamp holders already assembled.) Tuck the wires inside the channel of the base, making sure they are not pinched.

Take one of the end pieces and extend it across the end closest to the ballast (farthest from the black wires and white wires). The end piece is cut so that the leg of the lamp holder mounting bar fits into the slot. Gently hammer the end piece to a flush position. Notice the round indentation or *knockout* in the end piece you have not used, and carefully remove the knockout with pliers or a hammer and screwdriver. Some knockouts can be removed by hand. Unscrew the lock nut from a Romex connector (see item 8), then push the neck of the connector through the knockout so that the part with the clamp faces out and the lock nut is on the inside. Screw the lock nut back to the connector, so that it is snug and does not wiggle. Then attach the fixture end to the base, making sure that the screws on the connector face up toward you.

Assemble the other fixtures in the same way. One fixture must have connections on both ends.



Assembled Romex connector.



Handy box with Romex connectors attached.

5. Three-conductor cord. Buy approximately 6 ft. (1.75 m) of 16/3 SJ cord to connect the exposure unit to a wall socket. Buy 15 ft. (4.5 m) of 14/2 Romex nonmetallic, sheathed cable with ground wire. This white Romex cord is used to connect each fixture to the next, and both types of cord are available at electrical suppliers.

Three-conductor means that the cord is made up of a black (live) copper wire, a white (neutral) copper wire, and a green copper ground wire.

6. Three-prong plug and (optional) three-prong adapter. The plug is called a *male cord cap* at an electrical supply store, and the adapter is needed if your wall socket will not accept three prongs. You also will need a single-pole 15 amp switch.

7. Medium wire nuts. You will be using 15 wire nuts, purchased from an electrical supplier or hardware store, to join the white, black, and green wires to wires of the same color. If any of these wires are not long enough, extend them using extra wire and wire nuts, such as Eagle #44 wire nuts.

8. Romex cable connectors. You will need nine, to attach to the light fixture and handy box (see item 9) to prevent the cord from rubbing against abrasive edges.

9. Handy box and handy box switch cover and grounding screw. This is an electrician's metal fixture box.

Use pliers to remove two knockouts in the handy box: one in the middle of the long side of the box and one at the end of the box. Attach Romex connectors (as described previously in item 4) in each of these knockouts.

10. Screws. Fourteen ¾ in. (2 cm) self-tapping (pan head) sheet metal screws can be purchased at a hardware store. Twelve will mount the fixtures to the plywood, six of which will also serve as a ground for the wire. Two screws mount the handy box to the plywood.

11. Nails. Buy 1 pound (0.5 kg) of 8-penny finish nails.

12. Tape (optional). Aluminum, stainless steel, electrical, or cloth tape approximately 1½ in. (3.75 cm) wide may be used as you work to secure the wires to the sides of the exposure unit to keep them out of the way as you work. Alternately, you can staple the wires, making sure the staples go across and over the wires rather than through them.

Tips

- The way to strip Romex cord is to take a sharp utility knife and slice a groove down the middle. Then, peel and cut off the outer jacket. Remove the cardboard that surrounds the bare copper ground wire. After stripping, check wires to see that insulation is intact.

- Make sure that the outside jacket of both Romex and SJ wire is under the Romex connector, and that you tighten the connector onto the jacket, not onto bare wires.

- Always twist wire clockwise in the United States.

- You should never see bare copper wire after twisting on a wire nut. Black wires and white wires are power wires, but it does not matter if the copper from the ground wire shows.

- Pull on the cord to make sure the wire nut is secure.

- No wire should be showing where you connected the plug.

- While attaching the legs to the plywood, you should ask a friend to work with you. One person holds the board in place, flush to the plywood edges, and the other person hammers.

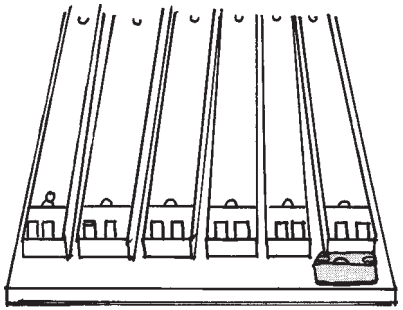
- The fixture covers should hide the ballast and wires.

- Dust bulbs before using the exposure unit and at monthly intervals. Accumulated dust will block light, thereby lengthening exposure times.

- I made one exposure unit with a galvanized aluminum lining and found that because the light reflected off the shiny metal, exposure times for printmaking were shorter. I have also seen exposure units painted white on the inside or lined with aluminum foil from the grocery store.

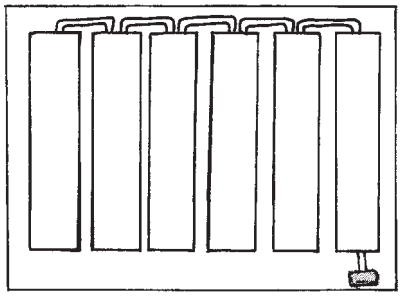
- I plug my exposure unit into a darkroom timer then plug the timer into a wall socket. At school, the unit is plugged into a surge protector strip, which makes it easy to turn on and off without having to put on goggles while using the switch near the bulbs. That system inspired one of my students to buy six ready-to-go, under-the-counter ballasts at a kitchen furnishings store and plug them into a surge strip. In that way, she avoided having to do any electrical wiring—a very quick, but more expensive, solution.

- Fluorescent lights will deactivate magnetic cards, such as charge cards, placed under them.



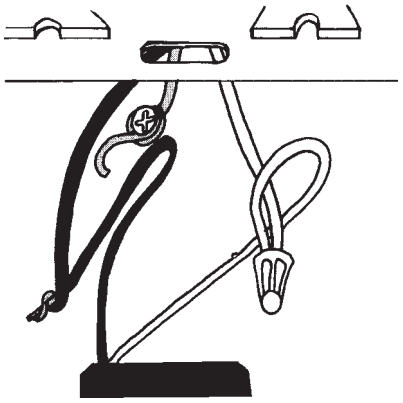
1

Handy box and fixtures are screwed down to plywood.



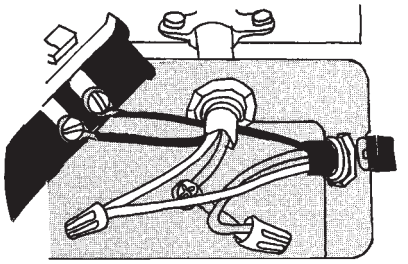
2

Six lengths of cord are cut and five are looped between each fixture. At the nonlooped end of an outside fixture, the sixth piece of cord is connected between fixture and handy box.



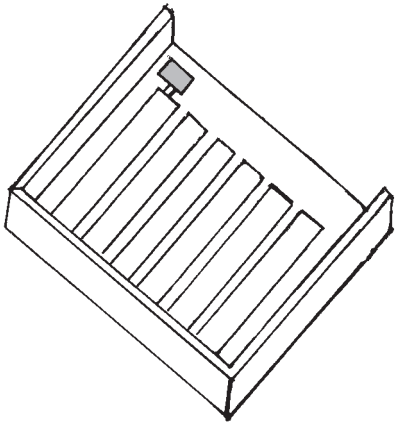
3

The insulation from both ends of the cord is partially stripped, revealing the colored wires inside, which also are partially stripped. Black wire twists around black fixture wire, and white around white. The copper wires are twisted and grounded and all wires capped. (Some fixtures are made with green grounding screw threaded into fixture bodies.)



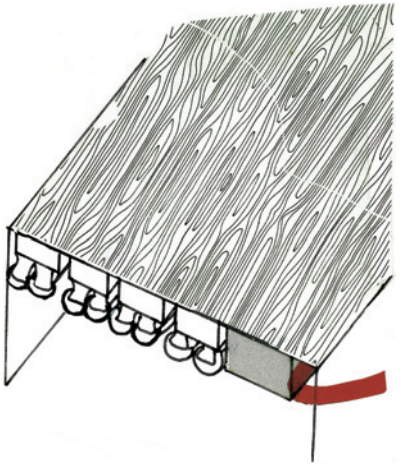
4

The SJ cord is entered into the handy box and the black jacket insulation is stripped, revealing colored wires inside, which also are partially stripped. Green and copper wires are twisted, capped, and grounded. White twists around white and is capped. The black wire from the SJ cord is twisted around a screw on the switch. The black wire from the Romex cord is twisted around another screw on the switch.



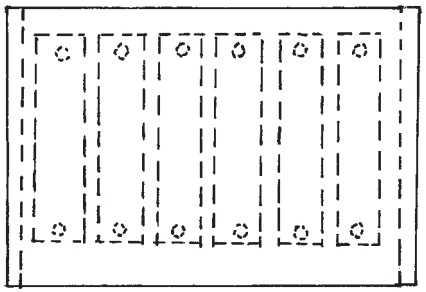
5

Three 1 × 10 in. legs are nailed to the plywood, two on either short side and one on the side opposite the switch.



6

The plate cover is attached to the handy box. The plug is wired to the SJ cord. The bulbs are inserted into the fixtures, and the unit is turned over.

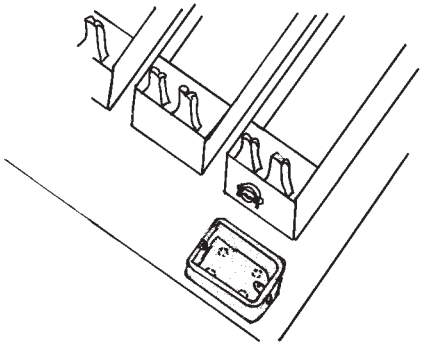


1

Mounting the fixtures

On the plywood, draw lines 1 in. (2.5 cm) from both of the 32 in. edges to indicate where the 1 × 10 pine board legs eventually will be nailed. Draw lines 2⅜ in. (6 cm) in from the 1 in. lines to represent the spaces between the legs and the end fixtures. Each fixture is 4 in. (10 cm) wide, and each space between those fixtures will be 2¼ in. (6 cm). Continue by drawing lines for the six fixtures and five remaining spaces.

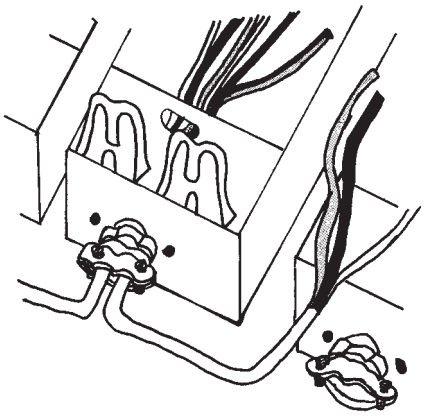
Lay out the fixtures, centered vertically, on the plywood, with the channel facing up. Put a pencil through the screw holes to mark the wood. After removing the fixtures, drill shallow holes at each of the marks. Replace the fixtures and screw but do not tighten them into the plywood.



2

Mounting the handy box

Place the handy box on the plywood, opening facing up and switch pointing out, so that it is 1½ in. (3.75 cm) from the head of the right outside fixture. Mark, drill, and screw the handy box into the plywood through the machined screw holes on the box.



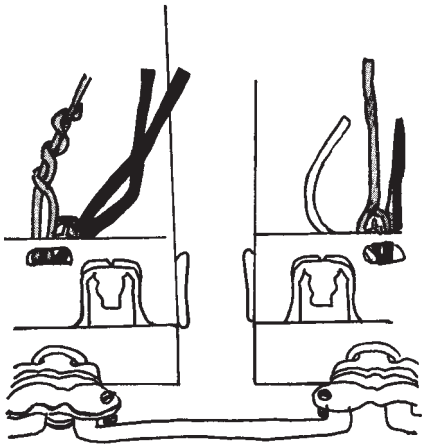
3

Connecting the fixtures

Using wire cutters, cut five 30 in. (76 cm) pieces of Romex. Taking care not to slice the insulation covering each wire, use a utility knife to strip 10 in. (76.25 cm) off the jacket from both ends of each piece of Romex. Starting from the outside, insert the end of one 30 in. piece into the channel of the Romex connector in the right fixture until the sheathing is under the connector. (Do not wire the same end as the handy box.) Screw down the connector until the cord is snug but not overtightened.

Insert the other end of the cord into the second fixture, but do not screw down the connector. Take another piece of stripped Romex wire and insert one end into the second fixture; screw down both ends into the connector.

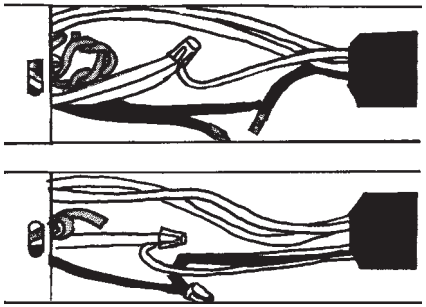
Insert and screw down the other end of the second piece of cord into the connector of the third fixture with the end of a third piece of cord. Continue to loop pieces of cord in a similar fashion, making sure by bending the cable that the wires do not hang out beyond the plywood.



4

Connecting the grounds

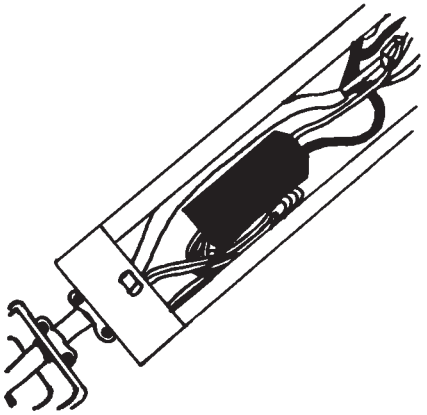
On the first fixture, wrap the bare copper wire (again, the fixtures may come with a green grounding screw) clockwise around the mounting screw, then tighten down the screw head. On the middle fixtures, twist the two copper wires tightly together clockwise a few times with the pliers. Take one of those copper wires and forcefully wrap it around the mounting screw, which is then tightened down. Do this to each fixture.



5

Connecting the wires

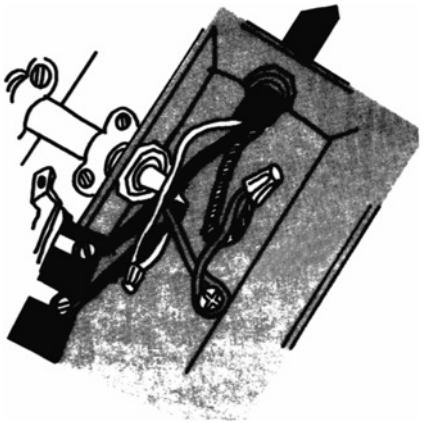
Use the utility knife to strip ¾ in. (2 cm) of insulation off all remaining black wires and white wires inside the Romex cord. The next four fixtures will have three white wires (two that you strip and one already stripped coming off the ballast) and three black wires in a similar state. Use pliers to twist the two white Romex wires together, then snip them off so that approximately ½ in. (1.25 cm) copper wire remains. Wrap the white wire from the ballast to the other two spliced white wires, then screw on a wire nut snugly, so that no copper wire is showing. Connect all remaining sets of white wires together and black wires together in like manner. The outside fixtures each have two white and two black wires, which are twisted white to white and black to black and capped.



6

Wiring the handy box

On the end closest to the handy box, attach a Romex connector to the knockout in the right outside fixture. Insert the remaining 30 in. piece of partially stripped Romex cord through the Romex connector so that the cable passes the ballast and reaches all the black wires and white wires at the far side. Insert the other end and the rest of the cord through the closest connector on the handy box. Screw down both connectors. Strip ¾ in. (2 cm) off the white and the black conductor wires on the far end. Twist the three white wires together and screw on a wire nut. Twist the three black wires together and screw on a wire nut. Twist the two copper wires—one from the Romex and one from the fixture—together and cap them. (The copper ground wire from the fixture should have been wrapped clockwise around the mounting or grounding screw, as described in step 4.)



7

Connecting the SJ cord

Carefully strip 5 in. (12.5 cm) off the jacket at one end of the cord, and starting at the outside, enter that end of the SJ cord through the unused connector of the handy box, then screw down the Romex connector. Strip ¾ in. (2 cm) off the sheathing of the green ground wire inside the SJ cord. Twist the green to the copper wire of the Romex cord and screw on a wire nut. Twist the copper wire once clockwise around the grounding or mounting screw and tighten it down.

Twist both white wires together and cover with wire nut. Twist one black wire clockwise around the screw on the outside of the switch and the second black wire to the other screw outside the switch. Tighten both screws and cover them with a strip of tape.

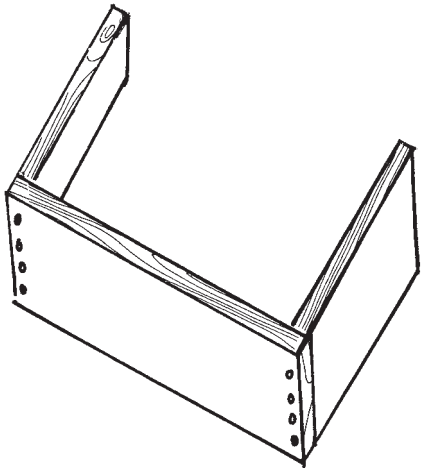
Gently fit the switch on top of the handy box. Using the two screws on the switch, fasten the switch to the metal tabs on the box using the machined holes. Place the cover over the switch and use its screws to attach the plate to the switch at the machined holes.



8

Attaching the plug

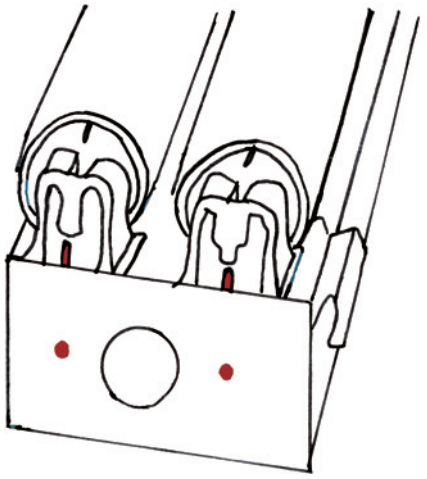
Unscrew and detach the prong part from the male plug. Carefully strip approximately 1½ in. (3.75 cm)—some devices have stripping guides on the fixture or an instruction sheet—of rubber insulation off the SJ cord and slip the male plug part over the cord to the edge of the insulation. Strip ¾ in. (2 cm) insulation from all three conductor wires, and twist each one separately so that it forms a more solid wire. Wrap the copper wire clockwise from the green ground to the green screw. Wrap the white wire clockwise around the silver screw, and wrap the black wire clockwise around the brass screw. Tighten all three screws and replace the prong part by screwing it down from the outside.



9

Making the legs

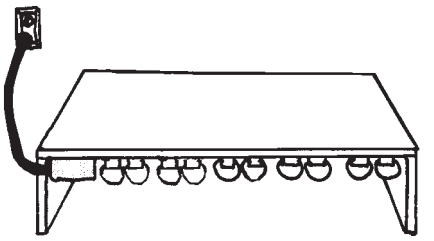
From the 1 × 10 board, use a tape measure, combination square, and pencil to mark off two 31¼ in. (79.5 cm) pieces and one 42 in. (106.5 cm) piece. Cut the pieces or have a lumber yard cut them. Abut the shorter pieces to the longer piece on either end of the longer piece. Starting 2 in. (5 cm) in from the top and bottom, hammer four nails into the corners. (Do not nail the short pieces to the end grain of the 42 in. piece.) Place the fixtures mounted on the board on top of the newly constructed legs. The handy box should be at the open end and facing down. Nail from the outside of the plywood to the width of the 1 × 10 s. Use four nails, spaced evenly and starting 2 in. (5 cm) from either end, on each of the short sides. Hammer nine nails along the 42 in. side, again starting 2 in. (5 cm) in from the corners and spacing evenly.



10

Testing the fixtures

Snap the fixture covers on so that they gently force the wiring down and securely attach to the fixtures. Insert the fluorescent bulbs, two to a fixture, by fitting the prongs into the channels on the lamp holders and gently twisting them until they take hold. Plug the unit into a ground fault interrupt circuit (GFIC), turn it on briefly, and make sure it works. *Do not look directly at the bulbs unless you are wearing special ultraviolet goggles.* If the lights do not go on, unplug the system and make sure that the bulbs are inserted correctly or that the grounds are properly connected on the ballasts.



11

Finishing the exposure unit

Remove the bulbs, unplug, and turn the unit over so that the switch faces you. Reinsert the bulbs, plug the unit into a wall socket, turn it on, and go to work! You may want to install the fan mentioned on page 67 and handles for transportability of the unit and a removable opaque flap/door on the front to prevent your accidentally viewing dangerous ultraviolet rays. My exposure unit is mounted under my work table, to save room, and it has a hinged door. Six in. (15.25 cm) under the unit is a pull-out shelf where I place the paper and glass for an exposure.

MATERIALS AND PROCEDURES

Materials

Most of the photo-printmaking techniques described in Part III are liquid, light-sensitive emulsions (or coatings) that you mix and apply to paper or fabric. You should read the preparation procedures described below before you start any of the processes. They may save you time and prevent frustration.

1. Image. You will need a transparent or semitransparent image, which can be used over and over again. Except for the daguerreotype in Chapter 12, bromoil in Chapter 13, enlargement emulsions in

Chapter 14, and alternative color processes in Chapter 15, the printmaking processes that follow are contact-speed; that is, they are not light sensitive enough to take into a darkroom and enlarge onto. You need to create negatives that are the same size as the finished picture. The emulsions reverse the negative transparencies to a positive print, or vice versa.

As described in Chapters 5 and 6, transparencies can be made photographically in a darkroom or on a computer, or nonphotographically by hand. You can place the negatives wherever you want on the emulsion. The edges of the transparency should be trimmed precisely, because the excess black film around an image will print as a random white border. In addition, you can coat the paper selectively but place the entire enlarged negative over those areas so that you print parts of the image, which is a great way to get away from the omnipresent rectangle.

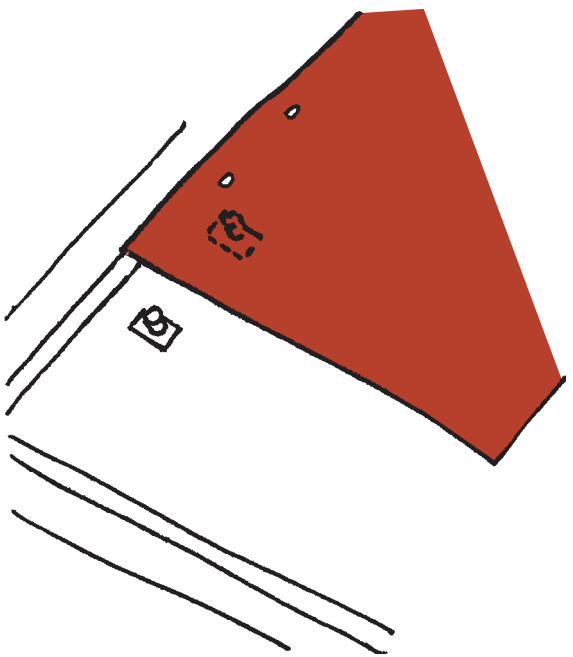
Blue Sunprints (see Supply Sources) produces yards of printed fabric without a transparency—they use flowers, vegetables (like red hot chili peppers!), and chain-link fencing to block light, thereby creating solid shapes and patterns. All these items are disposable, so ruining them by placing them on wet emulsion while making faster exposures is not a problem.

2. Masking sheets. Red acetate ruby masking sheets, which you cut to the size of your printing paper, are available from graphic design and offset printing suppliers and stationers. Although see-through, masking sheets do block ultraviolet light and keep the covered paper—even paper with emulsion on it—unchanged. As described below, you will cut a window slightly smaller than the negative, which is affixed to the masking sheet with narrow-width ruby or red cellophane tape. Do not use amberlith or paper masking sheets, because they do not block enough of the exposure light. (If you want the coating to show, negatives can be attached with clear cellophane tape or, even better, motion picture film makers' clear tape, to sheets of clear acetate or cellophane.)

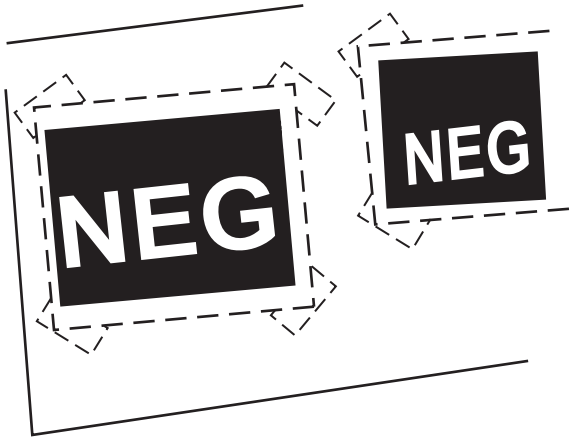
To mask gum, casein, and Kwik Prints (on the Focal website because it is no longer made), where you will probably employ more than one coating of emulsion, you may use many negatives, printing a negative in one color on top of another color. Photographic color separations or posterizations of the same images, for instance, as described in Chapters 5 and 6, are divided according to what color you want them to print. All negatives to be printed one color are attached to a masking sheet in the exact position where you want them to print. This exact positioning of negatives is called *registration,* and to register large negatives properly, you really need a light table, registration board, and registration pins, as described on page 4-64 of this chapter. Read that section before proceeding with the following instructions.

Insert index stock to the far-inside edge guide of a hole punch and make a set of holes in it. Relocate the index stock onto a light table where you insert registration pins through the holes from the underside. Tape the pins to the light table. Remove the index stock and place a masking sheet, previously cut to the size of your printing paper, under the index stock so that the edges of the masking sheet and index stock are flush. Use a permanent marker pen to draw circles through the holes onto the masking sheet, and punch holes at those positions.

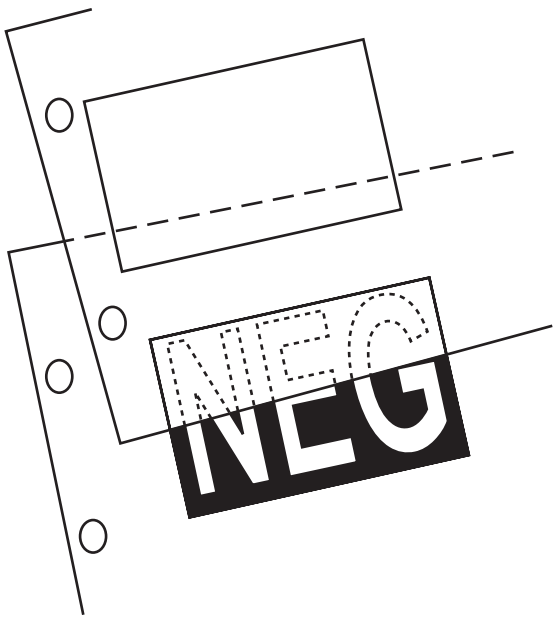
Put the holes of the masking sheet onto the light table registration pins. Place the negatives intended for the same coating of emulsion so that they read correctly on the light table. Attach tape,



Registration pins attached to light table and see-through rubylith masking sheet punched to match pins.



Negatives stripped to masking sheet.



Second masking sheet, with holes punched to match first sheet.

sticky side up, halfway onto the borders of the negatives and half unattached. Move the negatives until they are positioned under the masking sheet, then pat the masking sheet to the unattached half of the tape. Use a sharp stencil knife to cut and remove windows made on the masking sheets slightly smaller than the negative. This is called *stripping* the negative.

Punch holes in another masking sheet as you did before. Place it over the first masking sheet. Attach tape as you did before to all the negatives intended for the second coating of emulsion and adhere them, one by one, to the underside of the second masking sheet, making sure you have visually lined up the negatives with the ones from the first masking sheet. Continue in this manner with each set of negatives, cutting windows as you need them.

Tape a set of registration pins to the contact printing frame (page 66 of this chapter) in the same way you just taped them to the light table. A stripped-up masking sheet plus the identically punched printing paper will be held in place during each exposure by the pins.

I have also used rubylith shapes *on top* of the glass during part of an exposure to hold back light from an area that becomes too dark in the print. If you place the rubylith piece under the glass, it leaves a sharp edge in the print.

3. Supports. Paper can be made from a variety of materials, usually wood pulp and rags. Acid aids in the manufacturing process, and poorly refined wood pulp paper decomposes quickly. Some relatively inexpensive pulp papers are buffered to produce neutral acidity, which extends their life span. One such paper ideal for making practice prints is Archivart Standard. This paper is also recommended as a barrier sheet in the storage of prints (www.archivart.com). In general, however, buffers are alkaline and do not respond well to the iron-based cyanotype, van dyke, and palladium processes, where you might see the emulsion darken as you coat it and fade after you are finished.

Rag papers, although more expensive, tend to be long-lasting and of pleasing tactility. Those made with 100% cotton really print well with all the photo processes. Based on availability, absorbency, archival properties, and expense, I recommend one of the following for all the hand-coating processes (except gum printing, which responds to rougher cold press papers): Buxton with an extra white appearance; Rives lightweight with its off-white white or its equivalent in thickness, Arches 90 lb. hot press (whiter)/cold press for gum printing; Rives heavyweight or its equivalent, Arches 140 lb. hot press/cold press for gum; Rives BFK, which comes in white and a few colors; Saunder's Waterford; Strathmore one-ply hot press water color or tracing vellum (100% cotton and translucent) or its equivalent by a different manufacturer, Biengang 360; most rice papers; and Mohawk superfine cover stock, all available at good art supply stores. I find that, from year to year, the manufacturer might change the "recipe" some, and the paper I always depended on no longer works. But my new relatively reasonably priced favorite is Magnani Prescia, which comes in white, off-white, and pale blue. In addition, I have taken to using the very expensive Arches Platine for everything I want to do without any last-minute problems; I even use the back of Platine, which is rougher, for gum prints. Not only does Platine feel as soft as old bed sheets, but the internal sizing (explained in item 4) is really effective. Crane's Museo works well with a digital printer, as well as being coated with chemicals. Dan Burkholder (www.danburkholder.com) prints digitally over hand-coated palladiums on Museo. Arches' Acquarelle is tricky to coat because it absorbs so

much emulsion and it takes longer to wash, but the paper is a sparkling white and is great for transfers (see Chapter 1). The relatively inexpensive Biengang no. 501 drawing pad is fine.[2]

In the following chapters, especially Chapter 11, Platinum and Palladium Printing, additional papers are specifically mentioned for a method, but you might try them with other processes. Some art stores will charge a nominal fee to sell you small samples.

Make sure that the paper you choose is not too soft or absorbent and will withstand repeated immersion in water. To test it, soak the paper in water for ten minutes. If the paper fibers rise or separate, the paper will not hold up in these printmaking processes. If you hold rag paper in front of a light, you will notice a subtle water mark, which usually is embedded in the paper with the manufacturer's name and identification of the paper. Magnani Prescia is represented by a trident, which does not have a correct way to read it, so you have to look for screen marks to find the wrong side. Some papers, such as Aquarelle, display an embossed (raised on the surface) label. Use the side of the paper on which the water mark reads correctly. Don't be surprised if a paper you have worked with successfully gives you trouble after you purchase more sheets. As I explained in the previous paragraph, sometimes the manufacturer, without warning, changes the components, such as the internal sizing, which changes how the paper responds to the photo-printmaking chemicals.

Although many other papers will work, avoid multiply papers, which delaminate in liquids, and etching papers, which absorb so much of the emulsion that the chemicals will not wash out where you want them to.

Keep in mind that if you plan to make multiple exposures or to combine processes, you should preshrink paper before printing in order to ensure better negative registration. Preshrinking can be accomplished by the method described in Chapter 9, page 192, or by immersing the paper in a tray of very hot water for ten minutes. Preshrinking can be combined with the sizing recipe listed in item 4. Hang the paper, without weighting it, to dry.

Catherine Reeve, coauthor of *The New Photography* (see Annotated Bibliography), fully describes how to make paper by hand for the photo-printmaking processes. (An abbreviated version appeared in the July/August 1986 issue of *Darkroom Photography* magazine, and both writings include supply sources.) Please note that some paper makers recommend "curing" paper internally sized with Hercon 40 with heat or by letting it sit for 30 days before using it. Reeve does not mention this step. I have observed that papers made from abaca—or abaca mixed with cotton linter—gampi, and kozo do not need sizing, yet they produce impressively rich print colors. You can also buy Japanese Kozo or Hosho paper at a good art store, such as the ones listed in the Supply Sources at the back of this book. Hemp needs lots of sizing.

For a mural, my students and I used Tyvek (spun plastic) on a long roll we purchased at a building supplier, and we found that Van Dyke brown prints (Chapter 8) actually looked black on it, but we could not get cyanotype to work at all. Tyvek also comes as interleafing sheets available at a good frame shop, like Light Impressions Corp. (see Supply Sources) or as water-proof envelopes sold in a stationery store.

[2] In Central America, my students in Guatemala City have successfully used Grarro Watercolor paper, which is made in Spain.

Fabric can be used with all the processes, both light-sensitive and light-insensitive. Natural fabrics, such as muslin, cotton, linen, or silk, work best with Polaroid image transfer, cyanotype, Van Dyke brown, gum bichromate, and casein pigment printing. Mercerized cotton, which is cotton that has been specially treated in manufacturing, displays an affinity for photo emulsions and will yield intense color. Synthetics, such as Dacron and cotton blend or acetate bridal satin, available in a wide array of colors, are fine for van dyke and gum. Natural and synthetic fabrics accept magazine transfers and enlargement emulsions. To print multiple coatings and exposures of any process on fabric, make sure that you preshrink fabric in hot water, which also aids in ridding the fabric of the heavy sizing many manufacturers use. These sizings and finishes help protect the fibers but make the fabric unsuitable for photo-printmaking because they repel the emulsion. Iron the material flat before starting. An unwrinkled surface makes coating easier and provides for better contact between fabric and negative. When coating many pieces of porous fabric at one time, you can avoid wasting chemicals by stacking pieces so that excess emulsion bleeds through the top piece to the one underneath. And don't forget that the originators of these processes worked on leather and wood! See page 153 and 163 of Chapter 7, Cyanotypes, for more detailed instructions.

Store finished prints, whether on fabric or paper, in acid-free paper or polypropylene and archival storage boxes.

4. Sizing fills the spaces between the fibers in paper pulp or fabric with a water-resistant material, which strengthens the support while it holds the image on the surface, improves definition and tonal separation, and helps prevent staining. Because sizing requires absolute cleanliness in the workspace (why ruin expensive paper with grungy tools?), is time consuming and slightly messy, you may find sizing several sheets at once easiest. You can apply sizing with a warm damp sponge, sponge brush, or spray bottle or by soaking your support in a tray of sizing solution. Be sure to remove all bubbles and blotches, or they will interfere with the coating of the emulsion. Different sizings can affect the color of the final print, so experiment. I never have found it necessary to size with cyanotypes unless I use a heavy paper such as Rives BFK. Remember to wear protective gloves and a respirator during the mixing and coating procedures. Read item 3 first.

Type of Sizing	Methods It Works With
Alum and spray starch	Cyanotype, gum, casein, platinum/palladium
Gelatin and hardener	Cyanotype Van Dyke, gum, casein, platinum/palladium
Arrowroot or cornstarch	Cyanotype, gum, casein, platinum/palladium

Alum and spray starch. This recipe, developed by Todd Walker, does not change the appearance of the emulsion or feel of the paper. Spray or pump starch from the grocer and potassium (aluminum potassium sulfate) or ammonium alum from a photo store (or pickling alum from a drugstore) work well to prevent stains with cyanotype, Van Dyke brown, and platinum/palladium printing. I use this recipe first then use only one layer of spray starch in between each coating for gum and casein printing. In addition, this method preshrinks the paper, which helps with multiple-coating processes.

- For 10 minutes, soak paper in tray of 1 tablespoon alum mixed with 1 qt (1 L) water at 90°F (32°C). Hang or fan-dry paper.
- Cover paper evenly with one layer of spray starch, sprayed in a horizontal motion. Using a clean sponge brush, lightly work starch into paper with horizontal strokes.
- Hang or fan dry paper.
- Spray vertically and lightly sponge vertically in same way. Hang or fan dry paper.
- Soak paper again in tray of plain 70°F (21°C) water for five minutes to remove excess alum. Hang to dry.
- Before each new color is applied, spray picture with starch and dry.
- For gum and casein, gum over palladium or gum over cyanotype, a layer of spray starch is needed before applying the bichromated emulsion.

You can substitute 1 part liquid starch mixed with 1 part water for the spray starch. This solution is applied to paper or fabric, but iron the fabric while still damp to set the starch.

Gelatin and hardener. Another sizing that retains the suppleness of paper and preshrinks at the same time utilizes unflavored gelatin, sold in grocery stores.

- Dissolve four envelopes or 4 tablespoons (28 g) of gelatin into 1 qt (0.95 L) cold distilled water. Let this mixture stand and swell for ten minutes.
- Heat the mixture to approximately 122°F (50°C), then pour it into a clean shallow tray.
- Dip both sides of a sheet of paper into the tray for one minute, turning the sheet over a few times.
- Remove bubbles and squeegee excess size by pulling paper over a towel rod or clean, rounded edge of a tray, or by wiping the surplus carefully with a clean brush.
- Hang paper, unweighted, in clean area to dry. It will shrink as it dries.

Gelatin solution can be stored and reused for up to a week. To prevent the gelatin from being washed off during processing later, the old recipes called for the size to be hardened in a bath of ⅞ oz (25 ml) formaldehyde with 1 qt (0.95 L) water. However, formaldehyde is so toxic that you cannot purchase it in many places, and I do not recommend its use. Instead, substitute alum hardener found in photography stores or standard 40% solution of glyoxal (see Art Craft Chemistry in Supply Sources). Make the following solution in a well-ventilated area: dissolve 1 oz (30 ml) 40% glyoxal in water *to make* 1 qt (1 L). Immerse the gelatin-sized and dried paper in a tray of this hardener bath for 5 minutes, rinse in a tray of room temperature running water for two minutes, and hang to dry.

Arrowroot. An old recipe for sizing combines 1½ tablespoons (20 g) arrowroot (available in the spice section of grocery stores) with 1 oz (29.5 ml) hot water. Mix to a paste consistency. Add 1 qt (900 ml) hot distilled water and boil the mixture to a thick cream for 5–10 minutes, stirring constantly.

Pour it into a tray and use it at room temperature. Or, try 1 tablespoon (14.5 ml) Argo Starch (from the grocery store) mixed with 2 cups (473 ml) water. Boil it for exactly 3 minutes before using it warm.

With all recipes, make sure to remove lumps or scum.

Polymer medium. If you are confronted by highlights that do not clear while gum printing or if you want to try Kwik printing (see Focal website) on rag paper, the following sizing will work but requires a little finessing. Although it will alter the softness of rag paper, polymer will not permit any shrinking of the paper after it is applied. This procedure requires you, after each exposure and development of the emulsion, to dry the paper and reapply just one layer of this size before adding another coating of chemicals.

- Dilute 1 part good quality white glue, polymer medium, or gesso (found in art stores) with 9 parts water at room temperature.
- Use a wide brush or sponge and coat in horizontal strokes. Dry. Then, brush or sponge on another layer using vertical strokes. Air or fan dry paper.
- Apply a third coating with diagonal strokes. Air or fan dry.

If you use diluted gesso, it will change the color of the paper slightly; gesso mixed with a little acrylic paint will change the paper to any color you want. Sand the gesso on canvas or paper before coating an emulsion.

5. Applicators. Soft house-painting brushes, which provide for a coating where the brush stroke can be seen, or polyfoam brushes, which render a flat, even coating, are available relatively inexpensively at hardware stores. Another option is a latex paint foam roller. Or you can make an old-fashioned disposable Blanchard brush used by the originators of many of these processes. Wrap a length of flannel or cheap velvet around a narrow sheet of glass or the plastic paddle inside a polyfoam brush and secure the fabric with an elastic band near the handle. Flat wood-handled and stitched white goat-hair bristled *Hake brushes*, available at art supply stores, or bristle pastry brushes from a cooking shop, work well because they do not have metal ferrules that might become contaminated by chemicals. I trim the bristles to approximately ½ in. (1.3 mm) so that the brush does not pick up too much emulsion. In addition, I dampen the bristles only slightly for the same reason. Some printers swear by the much more expensive Jack Richeson #9010 series synthetic blend spalter flat brushes with razor edges and the DaVinci #7055 series artist bristle flat spalter brush.

Emulsions can be sprayed on with old atomizer bottles. Platinum Press and Bostick & Sullivan (see Supply Sources) sell a glass (never dimensionally unstable, nor emulsion absorbing plastic) coating tube ("The Tube" or "Puddle Pusher") and Photographer's Formulary sells a similar device, the "Floater Coater," that facilitate an extremely smooth coating and save on chemistry. Sullivan suggests that to use a coating rod, you set up on a flat surface such as a piece of plate glass with sanded edges. Next, add a couple of sheets of newsprint to provide a slight cushion then lay down the piece of paper to be coated. Alan Greene, in *Primitive Photography* (see Annotated Bibliography), recommends using a nylon string rather than a coating rod. Any of these devises save on the amount of

emulsion used because you make a thin line of solution on the paper to beyond the image area and along the rod's front edge, pull the rod and emulsion down the paper, then push it back up the paper. If the coating does not look even, try one more pass, but the more you practice—you can try plain water first—the easier it is to coat in one forward-and-back motion. Remember, though, that all applicators should be washed after each work session, and applicators for one process should not be contaminated with chemicals from other processes.

The conventional way to coat with a brush is to use even strokes in one direction, then to push that same emulsion at a 90° angle. Although the first inclination might be to load paper with lots of emulsion in hopes of obtaining a dark color in the finished print, quite the opposite is true. Ultraviolet light seems to react more quickly on a thin layer of emulsion, except with very heavy papers. As a matter of fact, in order to remove excess solution before coating, I encourage students to draw the brush over the lip of the dish where they have poured the working solution. One can wait until the first thin layer is dry and put on a second thin layer to obtain much darker tones.

Some printers took to using Tween 20, which they dilute 1 drop with 5 drops of water to make a stock solution. One or two drops of this mixture are added to enough emulsion to coat an 8 × 10 in. (20.3 × 25.5 cm) piece of paper so that the sheet absorbs the emulsion correctly. Although I have not personally used it, now I am hearing complaints that it might cause problems, but you can order it from www.caymanchem.com and check the Material Safety Data Sheet on their website. Tween is supposed to prevent streaking in the coating if you let the Tween plus emulsion "sink in" for 1–2 minutes before hair drying it.

Paper can be floated on one side in a tray of emulsion. In order to conserve the emulsion, pour a small amount of it in a glass or porcelain tray and prop the tray at a 45° angle while dipping the paper.

The great platinum printer and John Cage colleague, Michael Silver, who once was in my class, but taught me so much, showed me this method for working on thin papers.

- Draw the area you want to coat on Bristol board or matte board.
- Place the thin paper on top. Use brushes that will not abrade the paper, such as one made by Winsor-Newton with acrylic bristles. Slightly dampen the brush in distilled water, then blot the excess.
- Pick up a small amount of emulsion with the brush and, holding it straight up and down, lightly push the emulsion across the paper and inside the drawn coating area that you can see through the paper. Be careful not to over-brush; this should be a light coating.
- Hang the thin paper on a clothes line with potato chip bag clips. Because the paper has a tendency to curl, you need long clips on the top and bottom edges. Dry in the dark.
- When the paper is ready, on four corners, secure it with Post-It Correction and Cover-Up tape (#658 by 3 M) onto an old resin-coated (RC) black-and-white or color photograph. Expose the paper/RC unit for approximately 20% less time than you would for thicker paper.
- Process the paper, still adhered to the RC print, in a deep tub, not a photo tray. Wet the unit then gently stick a gloved thumb under the paper as you dunk and dip the items in still water. In this way, the water/developer gets behind the paper and allows for a more thorough washing. Go

slowly so the water does not agitate too much. Use three buckets of water/developer, or keep changing the liquid as it becomes contaminated.

- Gently smooth the paper onto the RC print with the side of your gloved hand, then hang the whole unit to dry. Clip the RC paper to the clothes line and weight it on the bottom two corners with more clips. Before the coated paper completely dries, remove it from the RC backing and blot the print dry in a sketch book or blotter book. Or, put two sheets of sketching paper over the print only and iron the entity, then let the paper alone continue to dry overnight.

6. Trays. Nonmetallic trays larger than the dimensions of the support are recommended. Photographic trays, dish pans from the hardware store, large plastic bussing tubs purchased through restaurant equipment suppliers, or glass baking pans from flea markets also work well. My husband invented an inexpensive and workable tray system for my extremely large prints: he nailed together and polyurethaned lengths of 1 × 4 inch pine boards to make a frame, then draped a plastic drop cloth inside and secured it to the wood with strong spring clamps. I have been using these "trays" for years and can easily drain the liquids out of them by unclamping the plastic, removing the wood frame, and letting the fluids run off.

7. Contact printing frame and gray step tablet. Buy one or build one, as described starting on page 4-64. Make sure that the glass does not block ultraviolet light and is clean with each use.

8. Light source. The contact-printing, photo-printmaking techniques need ultraviolet light for making the exposures. Detailed explanations of ultraviolet sources were listed earlier in this chapter. Avoid carbon arc lamps since they emit imperceptible gases that are extremely toxic when inhaled.

9. Brown bottles. Recycled 1 qt (0.94 L) brown fruit juice bottles with tops, thoroughly washed, make excellent storage containers for the light-sensitive emulsions. Wash out empty beer bottles, discard the metal screw top, and buy plastic caps at a pharmacy or liquor store. Or, you can buy brown bottles at a photography store or drugstore. I like to avoid plastic, which tends to absorb the liquid chemicals, but it is getting hard to find glass. Label each bottle with a permanent marker as to contents, date mixed, and safety precautions.

10. Washer. Most prints need to be washed. You can use a siphon washer, available at photography stores and on eBay, or you can drill holes near the top of the sides of a tub or tray and place near the bottom a hose with running water. Both methods allow clean water to enter while contaminated water drains. You may want to purchase a photographic sponge to blot excess water from the print after the final wash. Avoid rubber squeegees, which often shred the paper.

11. Water. Use distilled water for mixing the emulsions; usually tap water suffices for washing prints.

12. Plexiglas™. A sheet of plastic or the smooth, clean back of a tray angled in the sink helps process the emulsions that call for a running water development. The plastic is first wetted, the paper is smoothly stuck to it, and water is gently sprayed on the print. The unused emulsion drips down and off the print. Nylon screening stretched over a wooden frame that fits inside your trays helps prevent delicate papers from ripping during processing.

13. Fan. Air drying with a fan is the fastest and safest way to dry sizing, emulsion, and printed images. Try a hair dryer with a cool setting to both sides of the support (heat can destroy the emulsion

and accidentally shrink paper and fabric). Or, air dry on frames stretched with nylon screening from a hardware store.

Sometimes when I am working, either sizing or coating paper, I hang up the sheets to dry. To avoid contamination from different processes, I have found that if I use a plastic-coated clothes line and different colored plastic clothes pins coded to different processes, I make my job a lot easier. Both can be easily cleaned.

Tips

- If your tap water contains contaminants, use distilled water to make sizing and emulsion and to wash the print. Fill the wash tray with clean water after discarding used water every five minutes for an hour.
- A stack of unfolded newspapers on the coating area prevents contamination. As you coat, strip off the top layer of newspaper when it absorbs emulsion. Or cover the work area with oil cloth available from the Vermont Country Store, which carries homey patterns, and Buckaroo's Mercantile, which carries lively Mexican patterns (see Supply Sources), and regularly wipe the surface clean.
- Wash mixing utensils thoroughly after contact with each chemical.
- By lightly drawing around your negative with a pencil on paper, you can indicate where to coat. Coat beyond the image area or coat an extra swatch of paper in order to watch the change in color during the exposure of cyanotypes and Van Dyke brown prints. Some Printers prefer to double coat. They let the first layer mostly dry before coating a second layer, claiming that they obtain richer hues. I find that a good negative exposed properly on the emulsion is the real secret to rich prints. With cyanotype and Van Dyke, the (free) sun is the best! Virginia Boehm Worthen (gini@ix.netcom.com, but found on www.duke.usask.ca/) notes that conventional exposure meters are of little value, but she uses a coin to provide information. When she coats paper beyond the boundaries of the image, she puts the paper and negative in a print frame then places a coin on top of the glass in the sun. By moving the coin aside periodically, she determines the degree of exposure by comparing the contrast between the area under the coin and the area surrounding it. She can also judge whether the sun has moved too low in the sky because the shape of the coin's imprint becomes oval. In addition, when the print is properly developed and exposed, the area under the coin should return to the original color of the paper.
- Your negatives can be damaged if they come in contact with wet chemistry, so make sure that coated emulsion is *absolutely dry.* Use a fan or a hair dryer on a cool setting; air dry flat or hang the coated paper or fabric to create drip patterns. If you hang the coated piece on a clothesline with clothespins, wash them before the next use to prevent stains on future paper or fabric.
- If you are using plants or other living matter under glass as your "negative," place a sheet of clear cellophane or plastic wrap from a grocery store on top of the emulsion and under the plants. They sweat as they heat up under ultraviolet light, and the liquid produced can stain the print. If you do not place plants under glass, they will not sweat, and you can expose them atop *wet* emulsion! The exposures are much faster, but the plants may be ruined by the emulsion.
- Tall objects can be placed on top of the glass during an exposure. They can cast shadows.
- Do not take a coating brush into sunlight or leave the brush sitting around—chemicals left on the bristles will be exposed, ruining the next coating. Wash and carefully dry the brush after each use.

- Exposure times vary. The level of sunlight, time of the year, and time of day affect the exposures; with artificial ultraviolet, the age of the bulb and its distance from the emulsion alter the exposures. Dust on bulbs can cause longer exposures.
- Double exposures can be produced by moving the negatives halfway through the exposure.
- Do not develop the print in bright sunlight: You risk overexposing the print from further contact with ultraviolet light (although I have had students do it that way on purpose to create a solarized effect).
- Cold-water procion dyes, embroidery thread, and appliqué offer additional possibilities on a fabric—or pure rag paper—print. Oil and watercolor paints, pencils, and markers can extend the design of a print on paper.
- Keep a small hand towel near you. I buy used ones at the thrift store, throw one over my shoulder while I work, and know I am helping the environment by not using paper towels.
- A dry-mount press is helpful for flattening your finished prints. Or, use an iron set for cotton on the back of rag paper. The heat often darkens the emulsion, a result you may be pleased by. I advise against dry-mounting your prints; you can photo-corner them or hinge them onto a backing.
- Do not discard "nearly perfect" prints. Experiment with them!

Safety

Completely read each chapter's directions before starting.

Always read and follow manufacturers' warning labels.

Most of the chemicals are poisonous. Store them beyond the reach of children, preferably in a locked cabinet.

When mixing powder chemicals, wear a respirator containing a dust/mist filter, available at hardware stores. For black-and-white photochemistry, use a respirator with a combination acid gas/organic vapor cartridge, such as ones made by 3 M or North. Mix chemicals in a well-ventilated area. Details on health and safety precautions are found near the end of the Introduction to this book, and suppliers are located in the back of the book under Supply Sources.

Mix and coat chemicals in a well-ventilated area to avoid inhaling fumes and particles. Wear protective gloves to avoid skin contact. Wear goggles to evade accidents with your eyes.

Never mix ammonia or ammoniated products with chlorine bleach—you will create deadly fumes. Wear a respirator mask when handling ammonia.

Add acids to water, but *never* water to acids.

Do not store, prepare, or eat food near chemicals, ink, or solvents.

Do not use mixing utensils for other purposes. Thoroughly wash paraphernalia after contact with each chemical.

Never look directly into the exposure light. You can purchase special ultraviolet protective goggles at a laboratory safety supplier. Avoid carbon arc lamps since they emit imperceptible gases that are extremely toxic when inhaled.



© Binh Danh, *Found Portraits Collection #7,* 20 × 65 inches, chlorophyll print and resin, 2006. Courtesy Haines Gallery.
The artist was born in Vietnam and immigrated to the United States as a baby. He has invented a technique for printing negatives onto the surface of leaves by exploiting the natural process of photosynthesis. He picks a tropical leaf, puts the stem in a baggie of water so it does not dry out, places a negative on top of it in a homemade exposure frame, and exposes the unit to sunlight from a week to several months. Coined "chlorophyll prints" by the artist, the fragile works about Southeast Asian culture and history are encapsulated and made permanent through casting them in solid blocks of resin. This piece utilizes imagery from the Cambodian Killing Fields/victims of the Khmer Rouge.

Chapter 5

Making Negatives: Analogue Method

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Most of the hand-coated techniques described in this book require a negative transparency to be made and placed in contact with a light-sensitive coating, and then that combination is exposed to light. The negative is removed, and the exposed emulsion is processed, yielding a final positive image the same size as the negative. Therefore, negatives from your handheld camera used in this way probably will make an image too small for your needs.

There are two main ways to generate large negatives: using photographic darkroom methods or using nonphotographic methods, such as drawings on acetate (discussed in this chapter) or using digital methods (see Chapter 6). Any of these types of negatives can be used alone or in combination with each other. The negatives can be used repeatedly, and they can be moved during the exposure to create double exposures.

WITH A DARKROOM

If you use a darkroom, you can make a negative with an enlarger, with an enlarger converted into a copy camera, or with black-and-white photographs. The first half of this chapter will describe these methods. Instructions for using a graphic arts process camera, which used to be in this book, are now on the Focal Press website.

Photography is based on light hitting a light-sensitive coating called the *emulsion,* which usually is made of silver particles commonly referred to as the *grain*. The emulsion on film used in handheld cameras is *panchromatic*; that is, it is sensitive to all (pan) visible spectra of light (*chroma*). The film described in this chapter, for use in a darkroom, is *orthochromatic* because it is not sensitive to red light, such as the red safelight in a darkroom, but is sensitive to blue light. (Black-and-white photographic paper is orthochromatic also.) One major quality distinguishes different types of orthochromatic film: whether it *reverses* or *duplicates* the image being projected on it. This chapter will concentrate on film that reverses from negative image in the negative carrier of the enlarger to enlarged positive transparency, then using that positive to make a negative, or to start with a positive slide in the negative carrier to obtain an enlarged negative. I am detailing reversal film because it is easier to find on the market. A less-detailed description of duplicating film will be given because I cannot find it anywhere except William Paul & Associates (see Supply Sources) or remaindered, but it does save time. Duplicating film imitates the same tones as the image projected on it—you get an enlarged negative from a camera negative or enlarged positive from a slide. Both reversal and duplicating film are becoming more difficult to find as the lithography industry, the biggest buyer of such products, turns more and more to digital methods.

Orthochromatic film can be bought in standard size sheets, such as 8 × 10 in. (20¼ × 25½ cm), 16 × 20 in. (40½ × 50¾ cm), and so on. Arista from Freestyle in the United States and Maco from Mahn in Europe also make rolls as well as sheets. The orthochromatic (*ortho*) film, also known as *graphic arts* film or *lith* film, might be available in obscure outlets, but I am limiting the discussion in this book to a few more readily available, specific brands, listed in the chart that follows.

Graphic Arts Films and Their Properties

Type	Properties	Enlarge onto Ortho Film with a
Berrger BPFB-18 Arista APH Fotospeed Lith Maco Genius Lith Film Badger Generic Lith Film	High-contrast or continuous-tone results, depending on chemical developer used (see illustrations below). And Always reverses from positive to negative or from negative to positive.	Halftone negative, continuous-tone negative, or high-contrast negative, which yields an enlarged positive. Positive is contacted on another sheet of reversal film to make a contact-size negative. *Or* Continuous-tone positive (e.g., slide), which yields enlarged negative in one step.
Wm Paul Trophy CSD: CameraSpeed Duplicating Film	High-contrast or continuous-tone results, depending on photo chemical developer used (see illustration below). And Always duplicates from negative to negative or from positive to positive.	Continuous-tone negative or high-contrast negative, which yields an enlarged negative.

Expanded from Bea Nettles, *Breaking the Rules: A Photomedia Cookbook*. Urbana, IL: Inky Press, 1977.



High-contrast image.



Continuous-tone image.



Halftone image.

Note: Because a printing press cannot reproduce a continuous-tone image, this is a halftone approximation. A continuous-tone image is similar to a conventional black-and-white photograph. Photo by L. Blacklow of a Mayan Family in Guatemala.

Developers and Their Properties with Orthochromatic Films

Type	Manufactured as	Dilution with water and development times	Special remarks
Paper developers:			
Sprint Print	Liquid in bottle.	For all paper developers: usually dilute three times what manufacturer recommends. However, if you use it less dilute = more contrasty results. More dilute = less contrast.	Tend to produce transparencies that look like black-and-white photos (slightly contrasty).
Ilford Universal	Liquid in bottle.		
Solutec D-72	Liquid in bottle.		
Kodak Dektol	Powder from which you make a liquid-stock solution.	2¼ minutes.	Dektol seems to be the most reliable.
Film developers:			
Kodak D-76	Powder from which you make stock solution.	Straight or 1:1; 5–7 minutes.	Tends to be more continuous tone.
Agfa Rodinol (may be hard to find)	Liquid in bottle.	1:25–1:50; 2–5 minutes.	Punchy, but hard, fine grain.
Or			
Photographer's Formulany Rodinol	Dry Chemicals in a kit.		
Clayton's	Liquid in bottle.	1:7; 3 minutes.	My favorite for continuous tones.
Lith A&B	Can be liquid or stock solution made from powder.	Mix equal parts A and B solutions; 2¼ minutes.	Very contrasty (eliminates middle tones).
HC 110	Liquid in bottle.	I use it 1:32, but the label suggests many dilutions; 6 minutes.	Syrupy concentrate. Goes from high to low contrast, depending on dilution.

Tips

- Paper developers tend to last longer than film developers in a tray. For instance, Clayton's, a film developer, gives the results that I like the most, it is expensive due to its brief tray life.
- Because developers last for a short time, mix them last, after you have set up the enlarger and mixed all the other chemicals.
- A German company, A & O, bought the entire Agfa chemical line. By the time this book is out, A & O (www.ao-services.de) may have products such as Rodinal on the market. When the equivalent of Rodinal is on sale, try it diluted 1:25 parts water, for a hard-grained, continuous-tone negative. Develop for 2 minutes 15 seconds for starters. If you are not satisfied with highlight detail, try developing for 4 minutes. Whatever time you decide on, keep it constant with succeeding sheets of film. Rodinol is especially effective with duplicating film, but it has a short tray life.
- Berrger has distributors all over the world, listed on www.berrger.com.

Safety

Store all chemicals safely in brown jugs or plastic-lined cube containers, out of the reach of children.

Keep your darkroom well ventilated at all times and wear a respirator with toxic dust filter when mixing dry chemicals. Avoid skin contact by using protective gloves, and do not allow chemicals to splash in your face. Wear protective goggles.

Developers are highly toxic by ingestion and inhalation. Concentrated stop bath can cause burns and irritation of the breathing passages and throat. Fixer and stop bath combined can produce a gas that is corrosive to the lungs. Old fixer solution produces toxic gas, so discard fixer that is not clear in color.

Be careful with electrical cords and appliances; nothing electrical should be within arm's length of a sink. You will move more safely in your darkroom if you maintain safelights at the maximum brightness that your materials will permit, as suggested by the manufacturer.

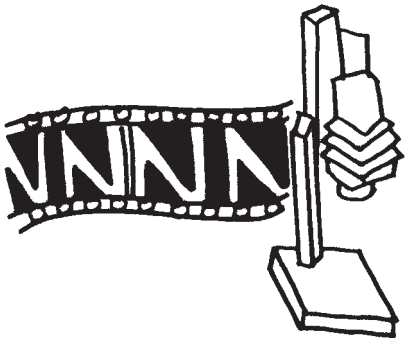
Read the manufacturer's warning labels before you use each chemical. When cleaning up, dump each tray of chemicals down the drain with plenty of water, disposing of them in the reverse order of how you used them.

Using an Enlarger

The former editions of this book detailed how to set up a darkroom and how to use an enlarger. That section is now on the Focal website or you can refer to a photography book on conventional black-and-white printing.

Method Overview

1. Your negative, placed in a photography enlarger, is projected onto orthochromatic film.



2. The orthochromatic film is developed to produce a positive transparency. The dry positive is placed on top of a fresh sheet of orthochromatic film and exposed to light.



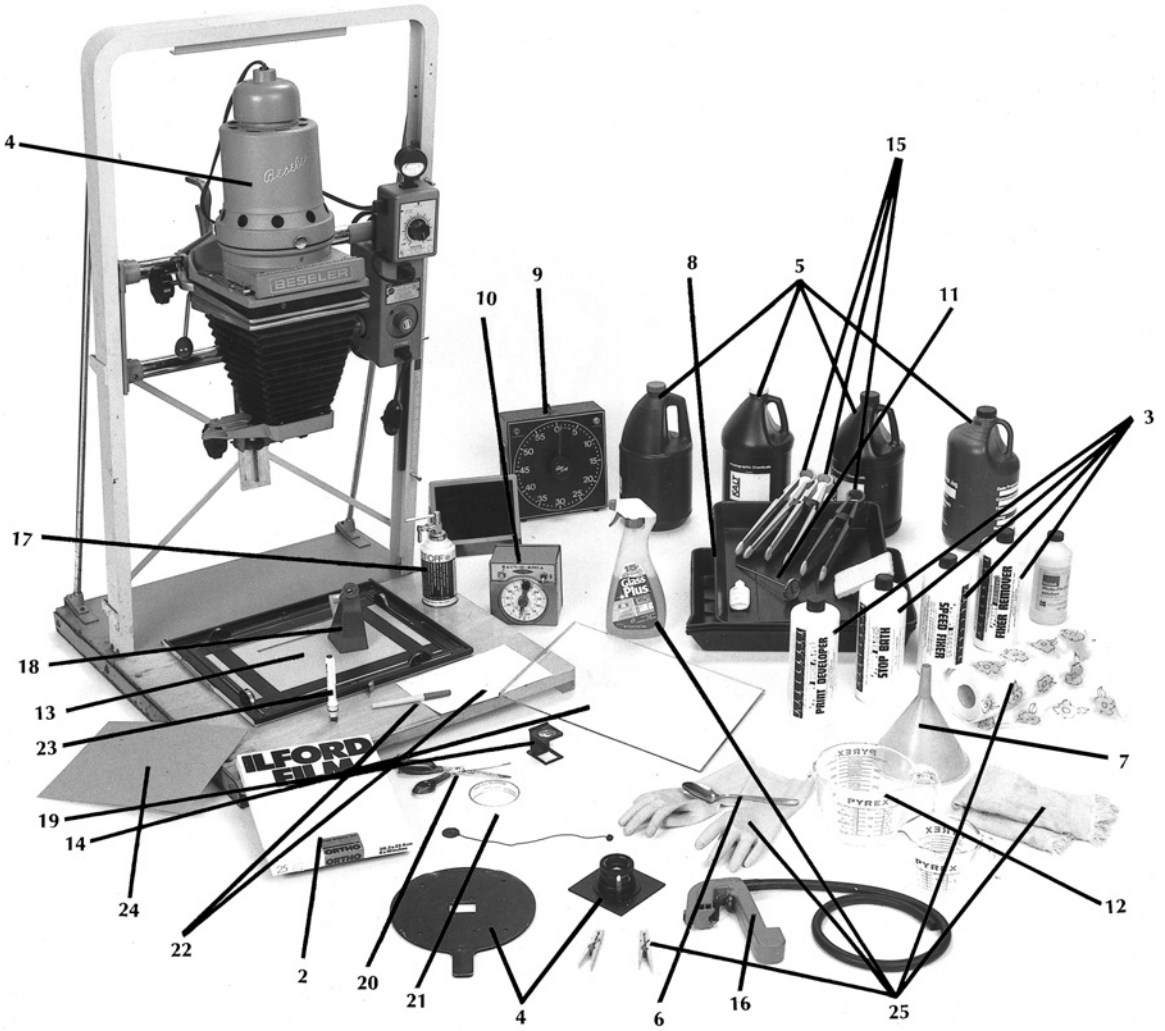
3. The fresh sheet is developed, producing a negative transparency.



Materials

1. Image. Use your own black-and-white film shot in a nondigital camera, or use semitransparent objects such as flower petals and leaves. Your camera-generated negative partly determines whether the print will be high contrast (consisting of highlights and shadows) or continuous tone (with many middle tones). Color negatives require more manipulation; kits are available to process black-and-white negative film into black-and-white slides.

Traditional photo printmakers use large format cameras to get 4 × 5 in. (10 × 12.7 cm) or larger negatives, which they make contact prints, thus eliminating the enlarging process. Many platinum printers rave about Pyro Developer (see Hutchings, *The Book of Pyro,* in the Annotated Bibliography) for developing these large-format negatives.



2. Orthochromatic film can be purchased from graphic arts/photographic suppliers or from printing suppliers. The best bet is ordering it online. I use Freestyle Photographic Supplies to buy small quantities of Arista and N31p, while William Paul will ship their reasonably priced duplicating film. I have found that duplicating films are inherently higher contrast. If you cannot locate what you want, write to the manufacturer (addresses are listed in Supply Sources) or call an offset lithography printer. Film should be stored in a cool, dry place.

Judy Seigel, editor of the wonderfully informative *The World Journal of Post Factory Photography*, suggests purchasing at a stationery store rubber finger tips—"the kind used for counting stacks of money"—if you are having trouble removing one sheet of film at a time from its package.

3. Photo chemicals needed include lith developer for high-contrast and halftone results or photographic paper or film developer for continuous-tone results, stop bath, fixer with hardener, clearing agent, and wetting agent, all of which are available at photography stores or online.

Developer. Light is projected onto the photographic emulsion and a latent (invisible) image is formed on the orthochromatic film in the darkroom. When the exposed film is immersed in the developer, the latent image becomes visible. Lith developer in powder form can be purchased in sets of two premeasured packages, each package making one gallon of stock solution A and one gallon of stock solution B. Photographic paper developer, such as Sprint Print™, Ilford Universal Print Developer™, or Solutec D-72 Developer (which I use instead of Dektol because it is the same formula but is not a powder), can be bought in small liquid quantities. Although you should use liquid over powder chemicals when possible to avoid the risk to your health by breathing in the powder, you can instead wear an acid gas/organic vapor and dust mask when you mix the powdered Kodak Dektol™. If making a negative to use with photo-printmaking techniques, use the developer three times as diluted as the manufacturer recommends, except for Ilford Universal Developer and Kodak D-76 (they work diluted as the manufacturers recommend). For Van Dyke brown prints, I prefer negatives developed in D-76 straight or diluted with an equal amount of water to make a less contrasty image. I develop the film for 5–7 minutes in a tray with gentle agitation. For blue and gum prints, I use Dektol as described in this chapter, and for palladium, I use Clayton's or HC 110. Diluted developer is dumped after a darkroom session, but stock developer has a shelf life of eight weeks in a stoppered brown bottle.

Stop bath. Even after film is removed from the developer, the chemicals absorbed into the gelatin emulsion continue to function and the image continues to build up, increasing both density (thickness) of film and contrast (lack of middle tones) of image. To avoid these problems, immerse the film in a weak acid stop bath—bottled by most photographic companies as 28% acetic acid *indicator* shortstop, which is a stock solution. It has an almost indefinite shelf life in a stoppered bottle and, once diluted, it will turn purple when no longer usable.

Fixer. Although the film is temporarily stable in the stop bath, the image is not permanent. The fixing bath (or *hypo*) makes the emulsion impervious to white light, and it washes off unused silver crystals. Most photography companies make a liquid-hardening rapid fixer, which helps prevent the emulsion from softening or scratching easily. Follow the manufacturer's recommendation for mixing film—not paper—strength fixer. Fixer can be saved after a darkroom session and later reused. A bottle of Hypochek™ by Edwal or the equivalent from other companies is a good investment, as one drop squirted in the fixer will tell you whether the fixer is still usable.

Clearing agent. Fixer can cause fading or discoloring of the negative if it is not washed out of the film. An efficient method to rid the emulsion of fixer, rather than washing for hours in water, is to

use one of the commercially available hypo eliminators, such as Heico Perma Wash. Follow the manufacturer's instructions for film clearing.

Wetting agent. Kodak's Photo Flo™ or any other wetting agent removes dirt and other particles from the film's surface and promotes the static-free (and, therefore, less dust-attracting) drying of the film. Dilute as the manufacturer recommends.

4. A darkroom with an enlarger. Film is sensitive to white light until it has been bathed in the fixer, so you will need access to a darkroom outfitted with a red safelight, such as a Red 1A. Because the photo chemicals are not healthy to breathe, the darkroom should have a good ventilating fan.

An enlarger with appropriate lens (50 mm lens for 35 mm camera negatives) projects light through the camera negative onto orthochromatic sheet film to make enlargements. The enlarger should include a negative carrier, a device for holding the camera negative in place in the enlarger. The rectilinear opening in the negative carrier has to be large enough to accommodate the size of your negative. Glass negative carriers are useful for projecting flower petals or other semitransparent objects.

Most enlargers are the condenser type, which can emit light that is too contrasty for many of the photo-printmaking processes. Either use a cold-head enlarger or insert a sheet of frosted mylar near the condenser to diffuse the light. Plan on needing more light for the exposure, and be aware that most enlarger lenses are sharper two "clicks" or stops down from full open.

5. One-gallon or smaller brown storage bottles for storing diluted photo chemicals. You will need one bottle for either print or film developer or two bottles for lith developer, one bottle for the stop bath, one for the fixer, and one for the fixer remover. Bottles may be purchased at photography stores, donated by your pharmacist, or recycled from juice. Bottles should be labeled as to contents and date mixed.

6. Stirring rod or stainless steel iced teaspoon to mix chemicals with water. Do not use a rod that can chip or break.

7. Funnel helps when pouring chemicals into storage bottles.

8. Photo trays or plastic dish tubs. At least three trays, slightly larger than the size of the film you are processing, are needed. To avoid contamination, mark each one with a laundry-marker pen: *developer, stop, fix*. You may want a fourth tray for the fixer remover, a fifth for the water wash, and a sixth tray for the wetting agent bath. If the developer tray is white and you keep it clean, you will more easily see if the developer has gone bad and turned brown during your darkroom sessions. Some photographers have taken to employing a used Jobo print processor (I see them on eBay), or a used BTZS tube (available through The View Camera Store) to process their enlarged negatives because it saves on chemistry and can be used safely.

9. Timer, such as a clock with a sweep second hand, is needed to time the steps when processing film. A special darkroom timer should range from 1 second to 60 minutes.

10. Enlarger timer with a range from 1 second to 1 minute or more is needed to control the exposure times.

11. Photographic thermometer showing at least 50–125°F (10–50°C) is used when adjusting water and chemical temperature during film processing. All photo chemicals should be used around 68°F (20°C), unless the manufacturer recommends otherwise. If developer goes below 65°F (18°C) or over 75°F (24°C), it will not work properly. Just remember my sad story: when I was in grad school, I printed in an unheated darkroom wearing a ski parka in the cold of a Rochester, NY, winter. No image came out no matter how long I exposed. In frustration, after wasting many sheets of film, I called a friend, who told me to bring a space heater into the room and place the developer tray in a larger tray of hot water. It worked!

12. Graduate or measuring cup is needed to measure and dilute chemicals for use. The most useful size is 32 oz (946 ml) with 1 oz (30 ml) increment markings.

13. Photography easel to hold the sheet film flat. Those with movable blades can crop the image projected on your film—a feature you may find practical—or you can use a clean, scratch-free piece of plate glass larger than the sheet of film. The problem with using glass instead of an easel is that it is another item to clean dust off and to avoid scratching.

14. Plate glass or contact printing frame a little larger than the sheet film size is essential when you reverse the enlarged positive to an enlarged negative for all photo-printmaking processes in this book. The glass must be absolutely clean and free of scratches; you may want to cushion it on a flat rubber mat and definitely sand the edges to prevent it cutting your hands.

15. Print tongs, available at photography stores, are used to move the ortho film from one tray to the next, and you must use different tongs in each tray of chemical solution. Label the tongs according to which chemical they touch, but do not put your hands in the chemicals at any time. Tongs are one of the least expensive items, so buy good ones that are easy to manipulate, such as the wish-bone-shaped plastic tongs with rubber tips. Metal tongs scratch the film. Judy Seigel, frustrated by most tongs as inadequate to do the job with sheet film, recommends "The Squibb," made by "pulling the bristles out of an old toothbrush with pliers, sanding the surface, and epoxying a tiny film clip onto it." She says that you can use the clip on the back of convention badges, too. Do not clip into the image area, but allow a ½in. border on the film, and wash the clips carefully after each use. Author and columnist David Vestal glued wooden clothespins, which do not rust, onto a strip of wood. I find plastic clothespins easier to wash of contaminants.

16. Siphon print washer or tray with holes punctured in the sides aids in washing sheets of film. You can make your own print washer or buy the one Adorama makes; siphon washers are plentiful on eBay. If you do not have a sink large enough to accommodate all the chemicals, place the trays on newspaper in case of spillage. The washing step needs to go on in a sink or bathtub. I have seen some photographers fill a tray with water, gently shuffle the negatives, empty the tray, and fill it up again with water. This procedure should be done for at least ten changes, but you must be extremely carefully not to scratch the film, which is especially fragile when wet.

17. Antistat brush removes dust from camera negatives and the enlarging lens without scratching them. It is available at photography stores. To protect our environment, I am not recommending canned air with freon or other gases.

18. Grain magnifier is a device that is placed on the easel to ensure accurate focusing of the image.

19. Loupe or magnifying glass is helpful when examining the quality of your finished ortho negative, and it is a necessity for viewing halftones. An 8× loupe can be purchased at photography or graphic art supply stores, and you can find an even stronger 12× loupe at silkscreen supply stores.

20. Scissors are needed to cut film test strips in the darkroom.

21. Masking tape comes in handy for labeling chemicals, holding steady test strips of sheet film, and other purposes. Thin black paper is good for covering the yellow or white of the easel, thus eliminating possible halation (accidental bounced light).

22. Record sheet for writing notes on exposure details is helpful. You can set up your own sheet, so bring a black pen or pencil into the darkroom with you. Jot down what you are doing (e.g., continuous-tone positive), what kind of ortho film and developer you are using, the size of the enlargement you are making, the f/stop and time, duration of the exposure and your evaluation of the outcome (e.g., "too dense"). The information you accumulate will give you a starting point for future darkroom sessions.

23. Flashlight. Some people use a small penlight flashlight for reading the f/stop numbers on the enlarger lens in a dark room, but more experienced photographers learn to count the clicks that indicate the aperture openings. A flashlight also can be used instead of an enlarger light, to expose film and create unusual drawings on film.

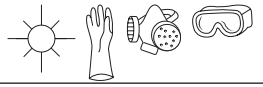
24. Opaque grey cardboard is needed to block light from the enlarger while exposing film for the test strip. Try using a piece 11 × 14 in. (28 × 35.5 cm) cardboard with 8 × 10 in. (20.25 × 25.5 cm) sheet film. If you puncture a hole approximately the diameter of a pencil in the center of the cardboard, you can also use it as a burning tool (see Tips, page 103). A wire attached to a cardboard circle can be a dodging tool (see page 103).

25. Glass cleaner, paper towels, hand towel, lens tissue, and protective gloves are all helpful in a darkroom. Clothespins and string, hung in a dust-free location, even a cardboard carton, make a drying system for negatives. For storing dry negatives, I use see-through print sleeves from an art store and saved glassine envelopes (from stamps purchased at the post office), which I put inside an empty photo paper box.

Making the Stock Solutions Step by Step

A stock solution is the main concentrate of liquid chemistry from which working mixtures are made.

Making the Stock Solution



High-Contrast Film Developer

Equipment You Will Need

Lith A and B Developer to make 2 gal (7.5L)
Two 1-gallon storage bottles
Graduate
Thermometer
Funnel
Label
Respirator with toxic dust filter
Neoprene gloves



Storage life: 2 months in stoppered bottles; 60–90 minutes in tray (depending on how many sheets of film are put through it).
To use: mix 1 part A with 1 part B.

Procedure

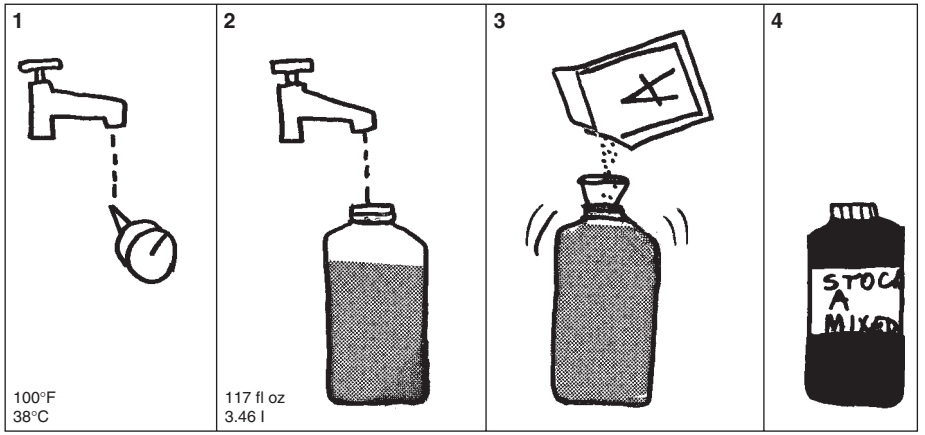
1. Adjust water temperature to 100°F (38°C).

2. Fill storage bottle with water to 3½ qts (3.3 L).

3. Slowly pour in powder chemical from packet A and shake until dissolved.

4. Label this *stock* lith A and note the date mixed on label.

5. Repeat this procedure, using clean implements, to make 1 gal (3.75 L) of stock solution B. Cool before using.



Making the Stock Solution



Continuous-Tone Paper Developer

Equipment You Will Need

Kodak Dektol to make 1 gal (3.75 L)
Gallon storage bottle
Graduate
Thermometer
Funnel
Label
Respirator with toxic dust filter
Neoprene gloves



Procedure

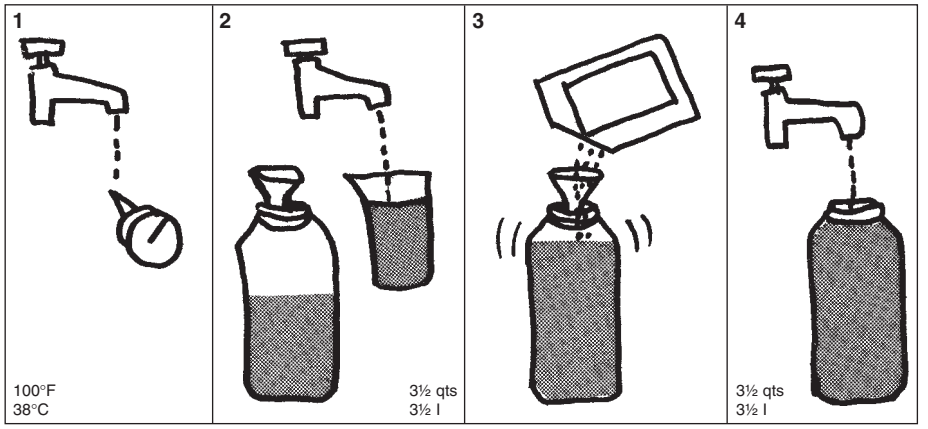
1. Adjust water temperature to 100°F (38°C).

2. Fill gallon jug with water to 3½ qts (3.3 L).

3. Pour in chemical and shake until dissolved.

4. Add water to make 1 gal (3.75 L).

5. Label this stock solution Dektol and note the date mixed on the label. Cool before using.



Storage life: 6 months in full bottle; 2 months in half-full bottle; approximately 1 hour in tray (depending on how many sheets of film are put through it).
To use: Mix 1 part Dektol with no more than 10 parts water. Do not overdilute or developer exhausts too easily.

Making the Negative

This section describes enlarging your 35mm camera negative to produce a print-size, full—tonal range positive on reversal orthochromatic film, such as Arista APH. In order to minimize grain and distortion, the full-size positive is then contact printed onto another sheet of ortho film to produce a negative. Please note from the chart earlier in this chapter that these directions can be adapted so that if you are starting with a slide that is a positive (rather than a negative), you can eliminate many steps, because when you project the slide onto lith film you will automatically create an enlarged negative. Or, if you have a negative and enlarge onto orthochromatic duplicating film, such as William Paul's Trophy, you will create an enlarged negative directly, thereby eliminating many steps. All of the sun-printing processes (cyanotype, brown, gum, casein, platinum/palladium) in this section of the book require an enlarged negative to produce a positive print.

Making the Test Strip

Finding the best exposure time required for ideal image density is essentially a process of trial and error, but a test strip makes the search easier and less expensive. A test strip is made by exposing successive portions of a small piece of ortho film for different lengths of time. With reversal film (see the chart earlier in this chapter) strips exposed for short periods of time will be thinner (more transparent) than those exposed for a longer time. However, with duplicating film (see the chart earlier in this chapter), the strips exposed for short periods will be denser (*less* transparent) than those exposed longer.

Finding the Emulsion Side

Open the box of film only in the dark or under the appropriate red safelight. Once you have broken the seal, you will find the sheets of film in an inner wrapping of black plastic or black paper that

protects the film from accidental exposure to light. Carefully remove one sheet of film, close the wrapper, and put the package back in the box. Ortho film has a light side and a dark side, which you can discern under the safelight. The light side is the emulsion, and it should be placed emulsion (light) side up when you put it under the enlarger.

Camera negatives tend to curve toward the emulsion side, which is somewhat duller than the nonemulsion side. When enlarging onto lith film, place camera negatives or positives emulsion (dull) side down in the negative carrier and shiny side up. When using duplicating film under the enlarger, place negatives emulsion side up in the negative carrier.

Tips

- Developer should be 68°F (20°C). If the developer is much too cold, it either will not work or will work slowly. If the developer is too hot, film will blacken too quickly or film will develop unevenly. To cool a chemical once it is in the tray, put ice cubes in a metal or glass beaker or Ziploc bag and place the beaker or bag in the solution to be cooled. If the temperature is too low, place a similar container of hot water in the tray; stir the developer with your tongs to even the solution temperature.

- Other chemicals should be 65–75°F (18–24°C).

- Dektol 1:1 produces higher contrast transparencies, while Dektol 1:9 yields lower contrast ones. Usually I use Dektol at a solution of 1 part Dektol to 6 parts water with students (due to budget constraints), whereas in my own darkroom, I use Clayton's for the positive. Subtle changes occur by changing developer dilution and development time, whereas changing the exposure makes grander changes.

- You are compressing the original negative when you create the positive. When you make the final copy negative, you expand that information, getting the maximum contrast without losing highlight detail. You probably will find that cyanotpes work best with a slightly contrasty negative, whereas palladium renders well with a slightly dense and flat negative. Therefore, you can make your negatives to match the process by somewhat altering the positive-to-negative step later.

- I hold the sheet of film with the emulsion parallel to and facing a weak white light approximately 3 feet (1 m) away. I use a table lamp fitted with a 15-watt bulb directed toward me, and I plug it into a digital darkroom timer. Then, I purposely fog the film for one-tenth or two-tenths of a second. I include the fog in the test strip described below. Note: the film does not fog where your fingers are, so that is another reason to include a border around your image. This procedure lessens the contrast slightly.

- When the developer has been exhausted, the film looks murky and greenish brown, rather than black.

- Some copy centers can make enlarged continuous-tone or high-contrast negatives from flat art. Several commercial companies will make digitally enlarged negatives geared to photo printmaking processes from your transparencies, computer files, or flat art. Or, see Chapter 6, "Making Negatives: Digital Method," and make them yourself!

Setting Up the Dry Side



1

Organizing the equipment

You will need an enlarger, timer, negative carrier, easel, negatives, cardboard, grain focuser, lens tissue, canned air, pen, record sheet, and scissors. Adjust easel blades to slightly smaller than the size of the film, or carefully clean both sides of glass.

Place the negative in the negative carrier with image upside down and emulsion down. Clean both sides of the negative with the antistat dusting brush. Insert loaded negative carrier into the enlarger.



2

Preparing the enlarger

Turn the enlarger's focusing light on and twist the lens aperture all the way open to give the brightest possible image. Use the enlarger's elevation control to raise or lower the head. This will change the general image size to match the opening in the easel. Make the image a little smaller than the film size so that you will have a border, which allows a place for your tongs to touch the film without possibly hurting the film's image area.



3

Focusing the image

Clean the enlarger lens with lens tissue. Using the grain focuser, look at the image while you move the focusing knob until the image looks sharp. Lock the enlarger. Center the easel under the enlarger and adjust the easel blades to the edge of the image.

You can raise or lower the head of the easel and refocus until the projected image is the size you want. Change the lens aperture to f/8 (or f/5.6 for duplicating film) and turn off the enlarger.

Setting Up the Wet Side



4

Preparing the chemicals

You will need developer, stop, fix, four clean trays and three clean tongs, wash tray, graduate, thermometer, and stirring rod. Wait to mix developer because it has a limited tray life.

Pour into stop bath tray approx. 20 oz (583 ml) of working strength stop bath for 8 × 10 in. (20.25 × 25.5 cm) film. The aim is to fill the tray with enough liquid that the piece of film easily will be covered by the diluted chemical.

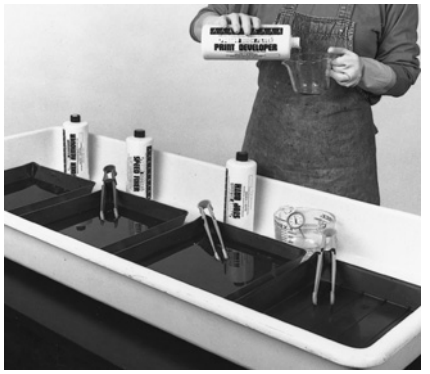
Pour into fixer tray 20 oz of working strength film fixer, and pour 20 oz fixer remover into another tray.

5

Setting up the wash tray

Place a washing tray in the sink, and attach tray siphon to it. Or place a tray with holes into the sink and drop a hose from the faucet into the tray. Fill the tray halfway with water near 68°F (20°C).

If your darkroom does not have running water, you can use a holding tray into which film is deposited after processing. At the end of the darkroom session, carry the holding tray into another room to wash the film.



6

Diluting the developer

Mix the developer to obtain a total of approximately 20 oz. For instance, use 3 oz (89 ml) Kodak Dektol with 18 oz (532 ml) water. If you are making high-contrast negatives, use 10 oz (296 ml) lith A developer with 10 oz lith B developer.

Because the developer does not last long in a tray, mix it last, but set it up as the first tray. Thoroughly wash and dry your hands before you return to the enlarger.

Making a Test Strip



7



Preparing and making the test strip

Remove one sheet of film from the box. (Optional: clip two corners, at diagonal edges of the film, and fog the whole sheet as described in the Tips on page 5-99.) Cut off a strip at least 5 in. (12.75 cm) wide. Return the rest of the sheet (with a clipped corner if you have fogged it) to the wrapping, place that package in the box, and close the lid tightly.

Place the unexposed test strip, emulsion side up, in the easel, positioned so it will cover the most important areas. Turn on the enlarger light for 3 seconds.





8



Exposing the rest of the strip

Cover one-fifth of the strip with cardboard, and expose the uncovered four-fifths portion for 3 seconds more. The band covered by the card now has 3 seconds: The rest of the strip has 6 seconds exposure.

Cover two-fifths of the strip with cardboard and expose the uncovered portion for 3 seconds. The bands covered by the cardboard now have 3 and 6 seconds of light, the uncovered portion 12 seconds.

Cover three-fifths of the strip, expose the uncovered portions for 3 seconds. The covered bands now have 3, 6, and 9 seconds of exposure; the uncovered portion 12 seconds.

Cover four-fifths of the strip, expose the uncovered portion for 3 seconds. The strip now has bands of 3, 6, 9, 12, and 15 seconds of exposure. Remove the strip from the easel. (You will need the long exposure mostly with duplicating film.)

11



Fixing the test strip

Remove the film from the stop bath with stop tongs, and immerse film in the fixer. Pick up the film with the fixer tongs and hold it toward the safelight. Notice its milky, opaque appearance. Return the strip to the fixer for 30 seconds.

Pick up the strip and hold it to the safelight again. Is it semitransparent? If so, immerse the strip in the fixer for 15 seconds more. Repeat this procedure until you can see the safelight through clear areas of the film. Notice how long that clearing took, and leave the strip in the fixer for that number of seconds more (twice the time it took to clear).



9



Developing the test strip

Set the timer for 2 minutes 15 seconds. Using tongs, slip the short side of the strip, emulsion up, into developer as quickly as possible. Start the timing and rock the tray gently for the entire development time. To ensure even development, *immediately* release the film from the tongs and tip the tray slightly so that the liquid is deeper at the other end, then lower the tray, causing a small wave of developer to wash over the film. Gently rock the tray for the rest of the time. For even less contrast, only use a gloved hand to sporadically move the chemicals lightly across the film emulsion for 2 minutes using Clayton's developer.



10



Stopping the development

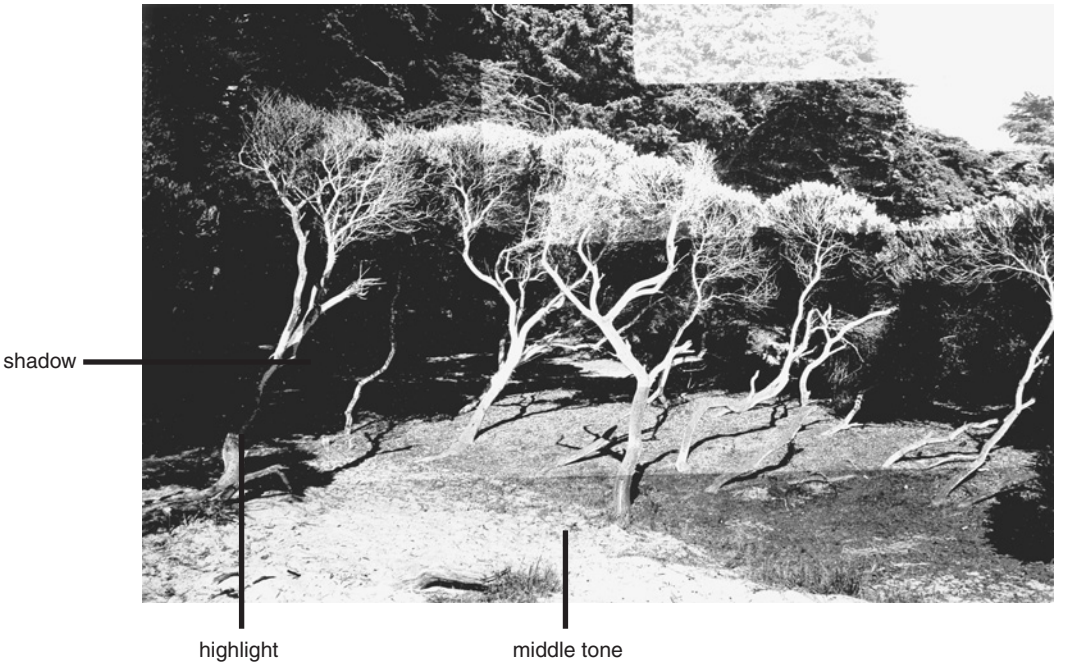
Using developer tongs, pick up the edge of the film and remove the strip from the developer. Slip the film into stop bath, avoiding contact with the stop bath by the developer tongs, which should be stored over the lip of the developer tray. Agitate for 20 seconds with gentle tray rocking.

12



Washing the test strip

Make sure unused film is put away, then turn the room lights on. Remove the film from the fixer with fixer tongs and wash the strip in running water for 2 minutes.



A typical test strip: the positive you create should contain the information, not the contrast, and look close in flatness to the original negative or slide. Therefore, it should be quite gray, light, and soft, without any totally black area.

How Should the Strip Appear?

Select the best exposure time based on density, contrast, and grain, and note the pertinent information on a record sheet. The length of the exposure and the f/stop determine the density. With lith film the more light that hits the film the denser the film becomes, whether you are making a negative or a positive. If the bands are too black, close down one f/stop to f/11. Conversely, the less light that reaches lith film, the more transparent it becomes. If all the bands are too clear, open up the aperture one f/stop to f/5.6. (With duplicating film, more light makes a more transparent test strip and less light makes it denser.)

Make sure you have created areas with some detail in the shadows and the highlights, if you have used a continuous-tone developer.

Diluting lith A and B developer other than as the manufacturer recommends is not advised. Rich blacks with no middle tones should appear if you have used A and B developer properly.

With a loupe, inspect the dried positive, preferably on a light table. Make sure the grain is in focus, even if the image is intentionally out of focus. For platinum-palladium printing, you will probably want a positive that looks flat with no absolutely clear area. You can obtain flat results by overexposing and strictly timing the very dilute developer.

Tips

- Limit your variables: keep the developer time the same, the temperature at 68°F, and the agitation gentle, no matter what results you obtain. Change the exposure for more or less density or developer dilution to change the contrast.

- The less diluted the developer, the greater the contrast and the less middle tones in the image. If you dilute the developer with more water, you will end up with a flatter, more grayish transparency.

- A procedure of briefly developing in (maybe 30 seconds) Dektol 1:2 until rich blacks appear then rinsing the film and finishing the development in diluted D-76 produces a wide range of tones appropriate for cyanotypes

- If the film turns out brown rather than black, the developer has gone bad or it is so diluted it has oxidized quickly. With duplicating film, it is helpful to make sure you have a little film under the easel blades, thus making a border. If that border is brown, rather than black, the developer is the culprit.

- If the film appears to have wave lines, almost like the waves of the ocean, big blobby bubble marks, or streaks that look like the bottom of the tray (if you used a tray with ridges), it probably is a sign of uneven development. Did you agitate the film as soon as it hit the developer, then consistently during development? Did the film stick to the bottom of the developer tray? Did you insert the film emulsion (light side) down by accident?

- If you are starting with a color negative or color slide positive, your results will be less detailed than starting with a black-and-white camera negative or slide.

- *Never* make a decision about exposure times by viewing the test strip under a safelight. Always judge by white light, preferably that of a light table.

- *Dodging* is a way of holding back light in an area, such as a shadow, that could end up so black that the detail would disappear. A circle of opaque cardboard 1 in. (2.5 cm) in diameter taped onto a 6 in. (15 cm) length of florist wire works well as a dodging tool. Using the wire as a handle, hold the tool halfway between the film and the enlarger lens and rapidly move it in a circular direction over the shadow area *during* the exposure. (With duplicating film, dodging will make a shadow less transparent and usually will add detail in that area.)

- *Burning,* conversely, occurs *after* the main exposure and adds detail in a highlight. Punch a hole the width of a pencil through an 11 × 14 in. (28 × 35.5 cm) piece of opaque gray cardboard. Hold this card halfway between the lens and the easel and turn on the enlarger light. You can see the image on the cardboard, so quickly position the hole over the highlight area and rapidly move the cardboard in small circles. (With duplicating film, burning uncovers detail in a highlight by making that area more transparent.)

Exposing the Positive



13



Exposing the film

Set the enlarger timer for the proper exposure as indicated by your test strip, then turn on the enlarger and check the focus of the image with a grain focuser or magnifier. Make sure the aperture is where you want it, and turn off the enlarger light. Fog a full sheet of film as before.

Securely place it in the easel, being sure to wrap up and cover the rest of the film. Make the exposure.



14



Processing the film

Develop, stop, and fix as you did for the test strip, using the tongs outside the image area to avoid scratching film. Slip the film into fixer remover for 2 minutes. Hook up the tray siphon, and with the room lights on, wash your film in running water for 5 minutes, then immerse it in a 20 oz tray of diluted wetting agent for 1 minute with no agitation. Hang the film to dry in a dust-free area.

Going from Positive to Negative

If you projected a camera negative onto lith film, you now have an enlarged positive, which you can save for special effects when you start photo-printmaking. (A positive transparency will print as a negative image.) You will need an enlarged negative, however, if you want a positive print. If you used duplicating film and a camera negative, you now have an enlarged negative and need not proceed with steps 15, 16, and 17.



An enlarged negative.



15

Checking the light

Remove the camera negative, carrier, and easel, replacing the easel with a contact printing frame or plate glass. Reinsert the empty negative carrier, and turn on the enlarger to make sure the head is high enough do project a rectangle of light that covers the area of the contact printing frame or glass. If you do not use frosted Mylar, throw the focus off just slightly so as to minimize possibly printing dust from the condenser. Again, start by setting the lens to f/8. Turn off the enlarger light.



16

Making a new test strip

Clean off both sides of the glass and place a fresh 5 in. (12.5 cm) strip of lith film, emulsion (light side) up, under the glass. Wrap up and put away the rest of the film and dust the dry film positive with canned air.

On top of the unexposed strip of film, place the dry film positive under the glass so that it is wrong-reading (reversed).

Use cardboard and make a test strip as you did in steps 7–12. Remove the test strip and process in chemicals as you did before.



17

Creating the negative

Having determined the correct exposure from inspecting the test strip, with dry hands take out a fresh sheet of lith film. Place the film under glass, emulsion side up, place the positive emulsion side down on top of the unexposed lith film, then position the glass on top. Expose for the determined time and remove the new sheet of lith film. Process in chemicals as before and hang the film to dry in a dust-free area.

Tips

- You can test for the emulsion by making a scratch outside the image area. If the black lifts off, you are scratching the emulsion side.
- *Do not* fog the film at this positive to negative step.
- Poor contact between the positive and the new sheet of film can cause out-of-focus images. You might employ a print frame, plate glass on top with hard rubber foam under the film, a sandwich with glass under and plate glass over, or vacuum frame, which evenly press the positive to the film. See page 4-65 for instructions on building a vacuum board. The weight of the glass plate eliminates the problem of poor contact, but the surface under the film cannot be warped.
- Lith film will start to develop if it just sits in the developer, but development will be slower and uneven, causing streaks. Since the amount of agitation affects the film, you must consistently and

Tips (*cont.*)

gently rock each tray of chemicals. Remember to use a tray larger than the sheet of film and to leave a border around the image.

- For this positive to negative part, I used to use Kodak HC-110 developer diluted 1 oz (30 fluid ml) to 32 oz (0.95 L) water. Because it is a syrupy concentrate, make sure you get every drop out of the measuring cup. Unless you have a drum or tube processor (see item 8 in this chapter's Materials list), you might find HC-110 frustrating to work with. It has very little capacity in a tray; that is, you either have to dump it or use HC-110 replenisher after each sheet of film. Following a few sheets, the results start to change even with replenisher. Repeatedly dumping a whole tray of developer can get costly to the budget and the environment, whereas drum and tube processors require significantly less chemicals and a development time of 4 minutes. In addition, if the developer goes bad in the middle of this stage, you have to redo your test process and recalculate the exposure.

- You can simulate full-color prints with gum bichromate and casein printing by making posterized negatives. Notice on your test strip that one band records mostly the shadows, one records the overall image (the one you selected already), and one records mostly the highlights. That is, one band should be 80% black, one band should be 50% black and 50% transparent, and one band should be 80% transparent. If you make three full-size negatives with these three exposures, you can use them later to print three different colors (usually a blue-green cyan, deep red magenta, and yellow). You should make all posterized negatives during the same darkroom session and without changing the height of the enlarger, so that they will be exactly the same size.

- Upon inspecting your negatives or positives, you may see clear specks or pinholes in the blacks. Different companies makes liquid opaque, and Grumbacher manufactures cake opaque for touching up with a 000 brush. I recommend red opaque so that you can see where you have retouched, and both kinds of opaques can be washed off. By applying four drops of red food dye mixed with ¼ oz (7 ml) water to a semitransparent or transparent area, you can slightly darken the negative, which will lighten the print. Make sure opaques are dry before you print.

- Unwanted black spots in clear areas can be removed by carefully scratching on the dry emulsion side with a sharp stencil knife. Dark areas can be lightened with diluted household bleach or Farmer's Reducer (from a photo store) on a cotton swab, followed by fixing and washing.

Making Color Separations

In Polaroid's wonderful *Instant Projects* (see Baker and London in Annotated Bibliography), Elaine O'Neil (her brown print quilt is reproduced on page 183, and she did a major part of writing Chapter 3) has written a clear explanation and provided funny illustrations for making direct color separations negatives for tricolor processes such as gum bichromate and casein printing. I have altered her instruction so that you can use other format cameras and films, but the advantage of using a large-format

camera is that you can contact print the negative without enlarging. The advantage of using Polaroid black-and-white film, which now is only made in large format sizes, is that you can check the quality of your resultant negative immediately.

You will need a camera loaded with black-and-white film or a large-format camera (such as a 4 × 5 in.) fitted with a Polaroid back and Type 55 P/N film. Sodium sulfite in a bucket is recommended for clearing Polaroid film. I buy all my Polaroid equipment—and I am a Polaroid devotee—on line. You also need a normal focal length camera lens, a tripod and cable release, an exposure meter, Separation Guide (color control patches) and gray scale from a good photography store, and filters to fit the lens (#47 blue, #25 red, #58 green, again from a photography store or online).

Your result will not be blurry if you work with nonbreathing, unmoving subjects, such as items you set up in a still life or a person who can really hold her or his breath! Include the color patches and gray scale at the edges of the image, so that you can later eliminate them. With Polaroid, you can shoot one negative with the patches, check their rendition on the film, and then shoot a second negative without the patches. Meter and expose the film as you would normally. Check the gray scale and the image to make sure you have clear divisions and detail in the shadows and highlights. Adjust the exposure if necessary.

Without moving the camera, add a new sheet of film or advance the roll and fit the blue filter over the lens in a filter holder (I even tape it), but increase the exposure by 2⅔ stops. Shoot. Remove the blue filter and film sheet, or advance to the next exposure on roll film, and fit the green filter over the camera lens. Expose a new sheet or frame of film with 3 stops more light than when using no filter. Finally, take off the green filter and take out the shot film or advance the roll film, and equip the lens with the red filter. With a new piece of film or new frame, use the same exposure as green if you are working in daylight or with electronic flash; use a 2-stop increase if the scene is illuminated by tungsten. Process Polaroid film immediately after each exposure. With conventional film, you will need to follow the manufacturer's instructions for developing the film. If you were using a medium- or small-format camera, then also use the instructions above for enlarging a negative with a darkroom and check the enlarged film to see if it closely resembles the camera-generated negatives. Or, scan your negatives and use the directions for the digital method of making negatives (see Chapter 6).

Converting Your Enlarger into a Copy Camera

To make negatives directly from a painting, photo, found images, or real object, an enlarger can be temporarily converted into a makeshift process or stat camera by reversing the normal use of the optical system. The material to be photographed is laid on the baseboard of the enlarger, and the lith film that is to record the copy is placed in the negative carrier above the lens. Any enlarger can be used, but working in a 35 mm format with a 50 mm enlarger lens yields the least detailed results. A 4 × 5 in. (10 × 12.5 cm) format enlarger with a 135 mm or 150 mm lens rivals the old professional process

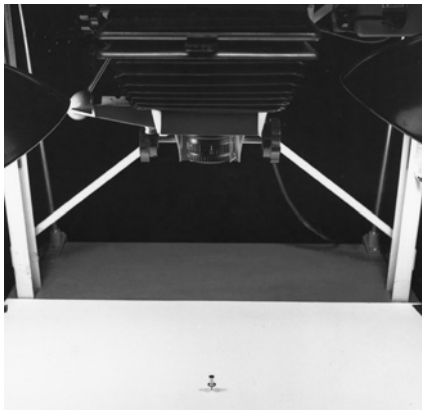
camera for recording detail. Working in 2¼ in. (5.25 cm) square format with a 80 mm lens gives the next best results.

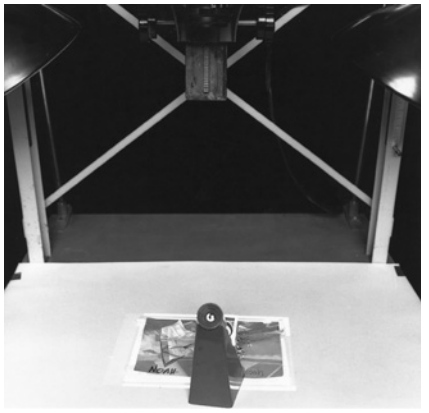
Any matching pair of desk lamps with 60-watt bulbs can be used for lighting the copy. Place them 6 in. (15.25 cm) beyond the edge of the copy and no higher than one-third the distance of the copy to the lens. Use an old camera negative to practice focusing and a sheet of white paper to cover the enlarger's baseboard.

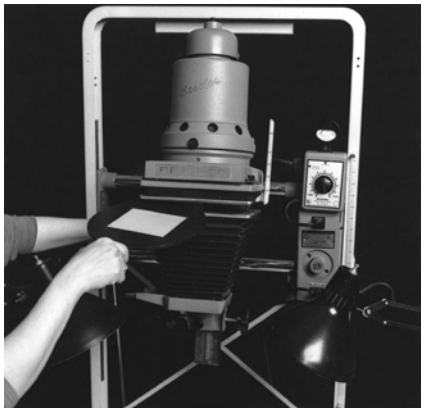
Tip

■ If you are copying real objects, use only shallow three-dimensional items because tall objects probably will be partly out of focus.

Using the Converted Enlarger







1



Setting up

Secure the white paper to the edges of the baseboard with tape.

Test the angle of two desk lamp lights by sticking a pushpin in the center of the baseboard directly below the enlarger lens. The enlarger light should be turned off, but the desk lamps should be on. Adjust the lamps until the shadows on either side of the pin are lined up and are of the same length and darkness. Remove the pin and turn off the lamps.

Center the artwork under the lens. Use masking tape to secure the corners of the copy to the white paper.

2



Adjusting the lens

Insert the empty negative carrier into the enlarger, and turn on the enlarger light. Correct the height of the enlarger head while adjusting the focus until a sharp-edged rectangle of light covers the copy and leaves little room to spare.

Place an old camera negative in the carrier. Use the enlarger light to project this negative onto your copy. With a grain magnifier in the center of the image area, carefully adjust the focus and double-check to make sure the projected light covers the copy. Lock the enlarger tightly, remove the negative and the carrier, and turn off the enlarger light.

3



Loading the negative carrier

Cut a piece of ortho lith film so that it fits flatly into the carrier. Place the film emulsion (light side) down (see previous instructions for "Finding the Emulsion Side," on page 98).

Insert the carrier with the ortho film into the enlarger, being careful not to jar the focus. The exposure probably will be between 2 and 30 seconds at f/8. Set the timer and the lens aperture, and make an exposure at 10 seconds.

4

Processing the film

Remove the film from the carrier and process it. Use a standard lith or paper developer, diluted as described in the previous instructions for "Making the Stock Solution" and in "Setting up the Wet Side." Stop, fix, clear, wash, and Photo-Flo the film as in steps 9–11 found on page 101, and step 14 found on page 104.

View the negative against a light table or window. Using a magnifying loupe, check the density and focus (see page 102, "How Should the Strip Appear?") If the negative is too black and dense, cut back the exposure time, and if the negative is too thin and transparent, add exposure time.

The Process Camera

Detailed instructions for using a stat or process camera have been eliminated from the book, but they can be accessed on the Focal Press website.

WITHOUT A DARKROOM

You can create alternative photographic prints without stepping into a darkroom, simply by producing imagery from real objects or stencils, drawings or photocopies on acetate, or old photographs made transparent. These techniques can be combined with each other or with the darkroom methods described earlier in this chapter.

Making Photograms

You can place objects directly onto the paper or fabric you have coated with one of the alternative photographic emulsions. An *opposite,* or *negative* print is made when the paper and objects are exposed to light—because wherever the object is, light is blocked, and the paper or fabric shows. Wherever there is no object, light will act on the emulsion and the color of the coating will show. If you move objects during part of the exposure or if you use semitransparent objects such as rice paper or tissue paper, you will obtain intermediate shades of the coating on the print.

Flat, semitransparent objects yield the most detail when placed under a piece of glass during contact printing to the emulsion; this also prevents the object from being blown around during outdoor exposures. For safety in handling, tape the edges of the glass and make sure the glass is larger than the paper or fabric; otherwise, the tape will leave a mark on the print.

For exactly repeating results or for making positive prints, you can place an object directly on ortho film and expose it to light to make a photographic negative as explained in the beginning of this chapter. You do not have to use an enlarger. Exposing the film with a flashlight, overhead light, or directional light in the darkroom can yield interesting results.



Martha Madigan, *Graciela Growth III, 1993–2003; Graciela Growth IV, 1996–2003; Graciela XII, 2002–2003.* **Each 40 × 24 in. giclee prints from toned kallitypes. Courtesy of Jeffrey Fuller Fine Art, Ltd.**
The Graciela Series are gold-toned, printing-out paper solar photograms reprinted as giclee prints that were intentionally altered in the color reproduction procedure. Madigan thinks of the process of her work as reflecting the passage of life. She uses the sun to reveal the exquisite form of a newborn baby and the sublime perfection of a young woman's body, as each summer she traces the progress of her daughter from child to young adult. Madigan lays out a sheet of coated paper in the sun and places objects or a person on top of it. She exposes the photogram for 5 minutes. In some cases, she develops that print and uses it as a paper negative to make another (positive) picture. In other cases, she removes the person and continues to expose the paper with objects placed where the person used to be. Then, she develops the whole sheet at once.

Tips

- If you are photogramming the pattern of a thin, printed fabric, place the printed side toward the emulsion and under the glass.
- Fresh vegetation and other living matter can sweat moisture under glass and thus stain the print, so use a large piece of acetate, cellophane, or clear plastic wrap available in grocery stores to cover the emulsion. Place the vegetation on top of the clear wrap, then cover the unit with the glass. For different results, eliminate the glass and place the vegetation directly on the emulsion. Depending on the time of day or direction of the ultraviolet light, the vegetation will cast shadows that show up in the print.

Making Stencils

Graphic arts and some stationery stores carry a nonphotographic red film called a *rubylith* masking sheet. It blocks light and is easily cut with a stencil knife. Rubylith is fairly transparent to your eye (but opaque to the emulsion), so it can be placed on top of a picture or transparency on a light table while the shape to be blocked out is traced and cut. Red masking sheets can be bought with a sticky backing, so that red shapes can be adhered to clear acetate to create functional negatives. You also can find rubylith in the form of a tape of various widths.

Photographic film exposed to white light or the black border of processed film can also mask light.

Tips

- Try using precut stencils, such as the opaque lettering guides found in art stores, to create text.
- I use rubylith or a cut-out portion of a reject print *on top* of glass to dodge the print during an exposure. If I were to put the rubylith cutout *under* the glass, the edge of it would be too sharp and visible on the print.

Making a Photo Paper Negative

If you have photographs made on thin, single-weight, black-and-white photo paper, you can use these pictures as transparencies to create images in alternative photographic print-making techniques. Because a photograph is a positive, however, you will end up with a negative final print, and exposures for the hand-applied emulsion described in this book will take longer. Compared with film negatives, paper negatives produce more contrasty results, but you can use a pencil on the photo to darken areas where you want to enhance detail or block out areas before you print.

You can enlarge a slide, which is a positive, onto black-and-white, single-weight paper in the darkroom and achieve a negative image, which can be used as a paper negative to produce a positive alternative photographic print.

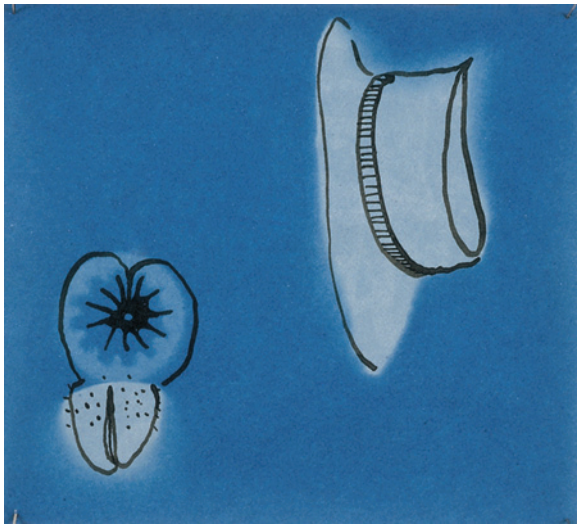
If you have a photograph on resin-coated paper, you can separate the plastic layer with the image from the backing by using a razor blade between the layers of one corner, then gently peeling the resin coating off. If you are having a problem, soak the photo in warm water, then try peeling again. You will have a positive transparency ready for use. Or, try the Polaroid emulsion transfer method described in Chapter 1, but transfer onto frosted acetate.

Even magazine pages on thin paper or newspapers can be used, but bear in mind that both sides of the page will print. The inventors of these processes started by coating tissue paper with emulsion, making an exposure either with photogram materials or with the tissue loaded in a camera, then contacting that processed and dried image to another piece of heavier paper coated with emulsion. In Chapter 4, I have described how to use thin paper on page 82.

One of the pioneers, William Henry Fox Talbot (see page 168 and 169, used to wax his paper negatives to make them more transparent.

With all these methods, the transparency must be weighted with glass during the exposure.

Using Cast Shadows



Sheila Pepe, *Photogram Projection,*
4 ½ × 4 in. cyanotype and ink on paper, 1995.
Private collection, Boston.

Tips

Selecting one of the printmaking recipes described in this book, coat paper or fabric in your studio, dry it, and load it into an opaque envelope such as black 4 ml polyethylene (available at hardware stores for garden mulching or as discarded packing from photographic sheet film and paper). Take the envelope outside, remove the coated paper or fabric, and place it so a shadow is cast on it. Exposure time will vary with the light of the day and the season of the year.

- First practice on a plain sheet of white paper to previsualize whether you will get a blur from the wind moving objects. Focus by moving the paper closer to or farther from the object casting the shadow, or create distorted patterns by angling the paper.
- Try folding paper or fabric loosely and allowing it to cast shadows on itself.

Images on Clear Acetate

Clear *media, frosted,* or *process* acetate, found in art and graphic design stores, can be used as the vehicle for drawings made with permanent markers, crayons, grease pencils, stamps and ink pads, typewriters, spray paints, pressure-sensitive graphics (press-type), or vinyl letters. To achieve sharp detail, contact print the acetate image negative to the emulsion by weighting it down with sheet glass, or soften the image by eliminating the glass. Acetate may slightly block ultraviolet light, requiring a little extra exposure when you print.

Tips

- A special acetate, available at photocopy centers, can be run through office copier machines to produce a positive transparency from a real object, pictures, or writing laid on the glass platen. Make sure you use the correct acetate for your machine. Some copiers will reverse the original to make a negative.

Using Special Effects Screens

Some art stores, such as Pearl Paint (see Supply Sources) stock a limited variety of adhesive-backed or pressure-sensitive printed patterns on a clear backing. I have even found small sheets in the greeting card section of stationery and drug stores and in craft shops. I found a wonderful array, reduced in price, from The Art Mart next to Maine College of Art in Portland, Maine. Some stores might still have grids, textures, lines, dots, topographics, and architectural symbols. Press them onto clear acetate and consider combining them with such household items as open-weave fabrics and doilies or with black ink drawn on the acetate.



Cyanotype on paper, artist unknown. Collection author.

Found Imagery

Old negatives of varying sizes can be found in family albums, flea markets, and auctions, and usually are rich in detail. The ones on glass can be contact printed as is to hand-applied emulsions; the ones on plastic need to be held down with a sheet of glass. In addition, newspaper publishers sometimes give away old negatives of type and halftone dotted pictures.

Transparentizing Office Copies

You can run clear acetate, onionskin paper, or reversal film with adhesive back through certain office photocopiers. Not all machines will take these materials, so check first with the manufacturer or technician. If you take your original art to any copy store, order the transparency made to your specifications. If the original is large, the operator can make copies of smaller parts of it that which you later tile together. "Adversity" can be an advantage!

Or, you can transparentize a photocopy on regular paper by rubbing Canola or another cooking oil onto it, letting it soak in for a day, then wiping dry the excess with a paper towel. You will know when the oil has sunk in by holding the copy up toward a light and looking at it from the back to make sure that the whole image area is transparent. The oil will not transparentize the paper indefinitely, because it starts to dry immediately and is gone in a few months.

Remember that you have a positive transparency, which will print as a negative image later. Place a piece of cellophane or plastic wrap between the oiled photocopy and the hand-applied emulsion to prevent grease stains on your final print. In addition, if you use melted paraffin wax, you can achieve the same effect without the wait. These transparentized copies can be contact-printed onto ortho film as described on page 5-105.

Sending Out Copy

Architects, designers, and mechanical engineers often send original artwork to print shops specializing in making large high-contrast or halftone negatives. Sometimes custom photography labs will make enlarged continuous-tone, black-and-white negatives from your camera negatives. More likely, you can have enlarged negatives made digitally at a service bureau. If you look under "computers" in the Yellow Pages, most service bureaus will be able to output a negative from your disk in either $8\frac{1}{2} \times 11$ in. (21.5 × 28 cm) or 11 × 17 in. (28 × 43 cm).

PINHOLE PHOTOGRAPHY

Text by Jesseca Ferguson and Step-by-Step Photographs by Walter Crump



Walter Crump, *Bay View,* 20 × 24 in. (50 × 60 cm), pinhole photograph, 2004.
This unique bleached and toned gelatin-silver print (Agfa Classic Multicontrast fiber paper) was contact printed from a fiber paper pinhole negative. The view recorded here, near Crump's South Boston studio, is from Black Falcon Pier looking across Dry Dock Bay. www.geocities.com/SOHO/Exhibit/3661/index.html. Photo credit: Walter Crump.

The authors are Boston-based artists who have worked with pinhole cameras for many years—Crump since 1987 and Ferguson since 1991. Their pinhole work has been published, exhibited, and collected in the United States and abroad, and they have each taught numerous pinhole workshops.

In an age when experience is becoming more virtual, the handmade aspects of photography become more important to the maker and the viewer alike. Contemporary images may be hybrids that combine digital methods with hand coloring, collage, and a nineteenth-century technique or two. In this climate of experimental imaging, pinhole photography offers unique possibilities.

Whether you think of your pinhole camera as a sculpture that takes pictures, a recycled object, or a large-format camera, it will be uniquely yours. You can customize, decorate, or embellish your pinhole camera any way you like. The design of your camera, when exhibited alongside the images it takes, can make a visual or political statement not possible with any other imaging method. There are many reasons to experiment with pinhole photography: the incredible distortions you can get in your images, economy, infinite depth of field (all objects depicted are equally in soft focus), multip-inholes (allowing multiple views simultaneously) large or unusual formats, etc. Almost any object can become a pinhole camera!

Safety

Please read the Safety section of this chapter, page 90 to become familiar with proper handling of darkroom chemistry.

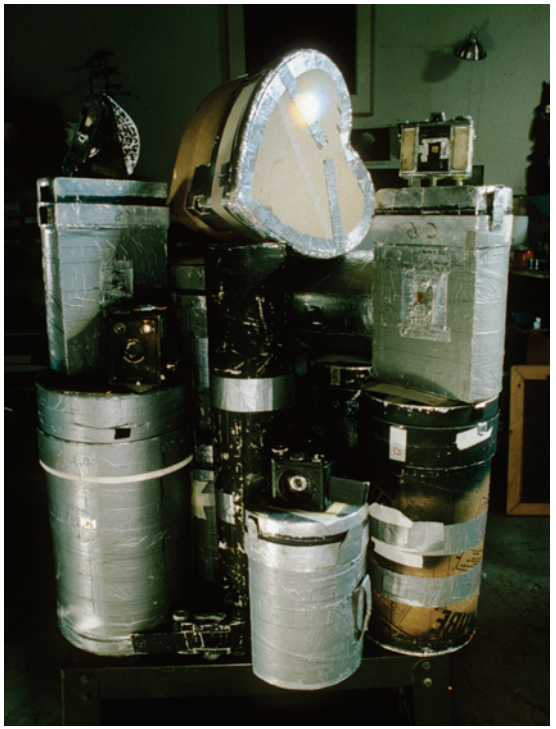
Observe sound safety practices when operating power tools, or working with scissors or mat knives.

Materials

1. Darkroom. See this chapter, pages 87 to 105.

2. Orthochromatic film or black-and-white photographic paper. Any film will work in a pinhole camera, but ortho film, as described in this chapter, can be handled under a safelight and is thus a good film to start with.

3. Potential pinhole camera. Choose a can, box, or other (potentially) light tight container that will easily accommodate insertion and removal of film or paper. Good examples include paint cans, oatmeal boxes, lunch boxes, purses, suitcases, guitar cases, 35 mm film canisters, garbage cans with lids, etc. Metal tins with tight-fitting lids, such as the ones used to package cookies or loose tea, have



Some of Walter Crump's homemade pinhole cameras.

a high success rate as first-time pinhole cameras. A conventional camera (any format) can be modified to become a pinhole camera. Simply remove the lens and replace it with a pinhole mounted in light-tight material, such as a lens cap.

4. Mat knife, scissors. These are useful for cutting metal stock for pinholes or for building a camera from scratch out of mat board or cardboard. In addition, you can cut strips of mat board or foam core to act as channels, keeping the film or photo paper in place inside the pinhole camera.

5. Black spray paint. Matte finish black spray paint can be used to darken the interior of your camera (especially recommended for white or reflective camera interiors). Lightly sand the inside of a metal box for better spray paint adhesion. Two light, even coats of spray paint will give you the best results. (Let the first coat dry before applying the second.)

6. Lightweight sheet metal. Brass shim stock (available from hardware stores and hobby shops), the flat part of an aluminum pie plate, or the side of a soda can all provide metal suitable for making a pinhole. (Aluminum foil will also work, but it tears easily.)

7. Sewing needles or pushpin. These are used to "drill" the pinhole.

8. Emery sandpaper. Sandpaper designed for metal is used to smooth away the burr created when drilling the pinhole.

9. Drill, files. These tools are used for cutting and smoothing holes in metal tins, wooden boxes, or other items being transformed into pinhole cameras.

10. Magnifying glass or photo loupe. These items are used to check your pinhole for roundness and lack of debris.

11. Canned air. A puff of air will clean pinholes of any debris left from sanding.

12. Black photo tape ½–1 in. (14–28 cm) wide. Black photo tape blocks light well and, therefore, is good for making a simple shutter or for mending light leaks.

13. Permanent black marker, black acrylic paint. Either item is good for touchups to reduce reflections inside a shiny metal pinhole camera interior. Thick black acrylic paint can patch small light leaks.

14. Weight or tripod (for cameras made with tripod mounts). These items can be used to steady your pinhole camera when working outside on a windy day. A brick can simply be placed on top of a camera, or a small metal weight can be attached to the top or bottom of a camera. (A good fastening method is removable, reusable adhesive putty available from art supply stores.)

15. Watch, notebook, and pen. These items help record your exposure times and results. Keeping good records will make your subsequent exposure times more accurate.

Method Overview

1. An ordinary object, such as an oatmeal tin, is turned into a pinhole camera. The interior of the camera-to-be is blackened (to cut down on interior reflections).

2. An opening is cut into one side or one end of the potential camera.

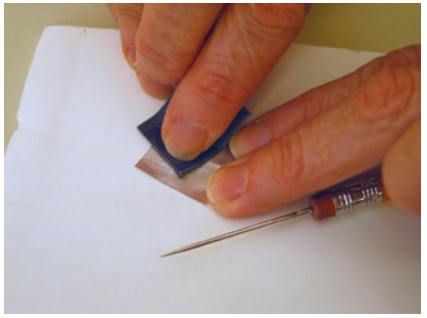
3. A pinhole, drilled into a 1 × 1 in. (2.5 × 2.5 cm) or larger square of lightweight metal, is taped in place behind this larger opening using black photo tape.

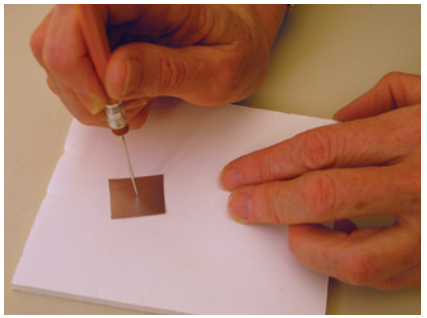
4. A flap of black photo tape is created to act as a simple shutter.



1
Creating the Camera

Once the camera-to-be is chosen, spray paint the interior matte black (unless the interior is already a dark, nonreflective color). Double check for potential light leaks (such as around the hinges and handle of a child's lunchbox) and repair them with black photo tape. Next, using a mat knife or a drill bit ½ in. (1.25 cm) or larger, cut a small window in the side or end of your camera, preferably centered (for better image coverage). As this opening will accommodate your pinhole, be sure to make it smaller than the approximately 1 × 1 in. (2.5 × 2.5 cm) square of metal containing your pinhole. File and sand down the rough edges around this window carefully, so that your pinhole metal can be taped in place snugly behind it (using black photo tape).





2
Making the pinhole

To make the pinhole itself, cut an approximately 1 × 1 inch (2.5 × 2.5 cm) square of metal, and place it on a piece of cardboard or foam core. Using a sewing needle with the blunt end covered in tape or embedded in the eraser of a wooden pencil (in order to cushion your finger) or pushpin, press down into the center of the metal square until the needle pierces the metal, leaving a burr on the opposite side. While pressing the needle into the metal, gently spin the metal and keep the needle vertical. This will ensure that your pinhole is round.

3
Refining the pinhole

Sand the burr down, using emery sanding paper, on both sides of the metal. Reinsert the needle into the hole as needed to drill and burnish the inside of the pinhole by gently spinning the metal around the shaft of the needle. Your goal is a perfectly round hole, free of metal debris, in a smooth metal plane. Holding the metal up to a light source, use a film loupe or magnifier to verify that your pinhole is round and free of debris.



4
Inserting the Pinhole

Center the pinhole behind the larger opening in your camera, and tape it into place with black photo tape. Attach your black tape shutter flap and you are ready to go into the darkroom and load your camera.



5
Loading the film or paper

In the darkroom, insert your light-sensitive material at the back of the camera, with the emulsion (light sensitive side) facing the pinhole. Hold the film or paper in position using reusable adhesive putty or tape (at the corners or in "rolls" at the back of your film or paper). This method also allows you to cut your film or paper into odd shapes. Remember to place your shutter made of black photo tape over the pinhole before leaving the darkroom.



6
Making an exposure

Work outside (faster than inside) for your first exposures, using a mixed light and shade situation and facing away from the sky or direct sun. Work closer to your subject than you normally would with a lens camera, and time your exposure in seconds or tens of seconds, even minutes, depending upon the light situation. To expose, remove the tape shutter and replace it at the end of the exposure. Indoor exposures may take hours (even days!) depending on the light situation.

7
Developing the negative

In the darkroom, unload the "negative" from your pinhole camera and develop your ortho film or photo paper as described earlier in this chapter. Develop by eye, in paper developer (1–2 minutes), followed by stop bath (30 seconds), and fixer with hardener (5 minutes) for film, without hardener for paper. Water rinse as the manufacturer directs (shortened for film by using fixer remover, as described on page 93). See pages 99–105 for further information on negatives and the processing of ortho film.

Experiment, get to know your camera, have fun—and welcome to the world of pinhole photography!

Tips



Jesseca Ferguson, ***Bird/Astronomy Book (constructed)*****, 14 × 10.5 in., (35 × 26.25 cm) collage constructed of 8 × 10 in. pinhole cyanotype, old document, old book board, 2003. www.pinholeFormat.com/jessicagal1.html. Photo credit: Peter S. Harris.**

■ Using black photo tape (with one end folded back for easy accessibility), make a simple shutter to place over the pinhole when not exposing your film or photo paper.

■ For exposure times, work by trial and error, keeping the following four factors in mind:

1. Light conditions (inside/outside, time of year, time of day, geographical location).

2. Speed of light-sensitive material (film or paper) being exposed in your pinhole camera.

3. Size of your pinhole (smaller pinhole is slower, larger pinhole is faster).

4. "Focal length," or the distance from your pinhole to your film/paper. A shorter distance means faster exposure, with a more wide angle view. A longer distance means longer exposure, with a more "normal" or telescopic view.

If you work consistently with one camera and keep notes on each exposure, you will learn a lot about light, about pinhole photography in general, and about that pinhole camera in particular. For those desiring more exact methods, see the exposure charts provided by Eric Renner in *Pinhole Photography: Rediscovering a Historic Technique* and other resources listed in the Annotated Bibliography.

■ Angle of view (normal, wide angle, telephoto). To get a "normal" looking image, measure your film/paper diagonally, then build a camera with a pinhole which is that same distance away from the film or paper. Thus, to produce a "normal" 4 × 5 in. pinhole image, build a camera that is 6 in. deep (the diagonal measurement of the 4 × 5 in. film). This 1:1 ratio is based on human sight: the diagonal measure of the receptors in the back of the human eye is equal to the eye's diameter. ("Normal" presumes that your film plane is flat, not curved, as in an oatmeal-box camera.)

■ Image coverage/focal length ratio. As the cone of light entering your camera from the pinhole is interrupted by the plane of the film, you will get different areas of coverage, depending upon the distance between pinhole and film plane (focal length). Pinhole expert and author Eric Renner discusses what he calls "the image-diameter-to-focal-length ratio" in his book *Pinhole Photography* (see Annotated Bibliography). Image diameter is approximately 3½ times the size of your camera's focal length. Thus, a 2 in. deep camera would give you approximately 7 in. coverage (7 in. diameter circular image). Keep this ratio in mind when making multipinhole cameras.

■ Image coverage and avoiding unwanted vignetting. The camera-to-be should not have thick walls, lest you create a "tunnel" effect that prohibits the light admitted by the pinhole from exposing much of the film or photo paper in the camera, thus resulting in a vignetted image. If your chosen camera object has thick walls, simply make the original window (which accommodates the metal pinhole plate) larger in order to permit a broader beam of light to enter the camera interior.

■ Reducing potential glare. The back of the pinhole metal may be blackened with marker to reduce glare, but be careful not to accidentally "fill in" your pinhole with ink.

Tips *(cont.)*

■ Pinhole size. Any size hole will work, with a smaller hole yielding a sharper image. For details on aperture size and focal length, see Chapter 5 of Eric Renner's *Pinhole Photography* or Jim Shull's *The Hole Thing*, listed in the Annotated Bibliography.

■ Built-in holder for film or paper. If you will be using a consistent size or shape of film or paper, you can make a simple in-camera film holder using channels cut from blackened foam core or mat board, glued into place opposite the pinhole.

■ Avoiding unintended blurring of image. Keep your camera steady on a firm surface throughout the entire exposure. (Move camera or subject for deliberate blurs.)

■ Troubleshooting negatives. If your negatives are completely dark, or are dark in certain blotched or streaked areas only, your camera may have one or more light leaks. Check your (empty) camera for light leaks by peering inside as you hold it up against a light source. Make any necessary repairs with black photo tape or black acrylic paint. If you can see some image, but the overall negative is too dark, you may be overexposing your film or paper. Reduce the light entering your camera by shortening exposure time or by exposing in a less light-filled setting. (Rarely will you need to correct overexposure by making a smaller pinhole.) If your negatives have little or no image at all, you may simply be underexposing them, given the light situation, pinhole size, camera depth (focal length), and speed of film or paper you are using. Possibly you may have forgotten to open the shutter, or may have loaded the film or paper backward (emulsion side away from the pinhole).



Youngsuk Suh, *Campers #1, North Carolina,* 35 × 47 inches, archival pigment print, © 2003.

Youngsuk Suh is a photographer and teacher. His recent project, "Instant Traveler," investigates the national park system and tourist attractions of the United States as a cultural institution. In his statement on the project he states, "Preservation of so-called *nature* is a manifestation of highly developed civilization. The authenticity of the nineteenth century explorer's experience becomes only a simulated experience to the visitors to the parks, where the visitors are kindly guided by well-prepared maps and guidebooks. The act of experiencing nature is another lesson for a civilized culture, which has to be learned and mastered. Travel becomes an empty word replaced by tourism." His interest is keenly focused on the intersection of nature and human civilization. His work has been exhibited nationally and internationally including his recent solo exhibition at Clifford Smith Gallery in Boston. His work has also been published in newspapers and magazines.

Chapter 6

Making Negatives: Digital Method

Youngsuk Suh

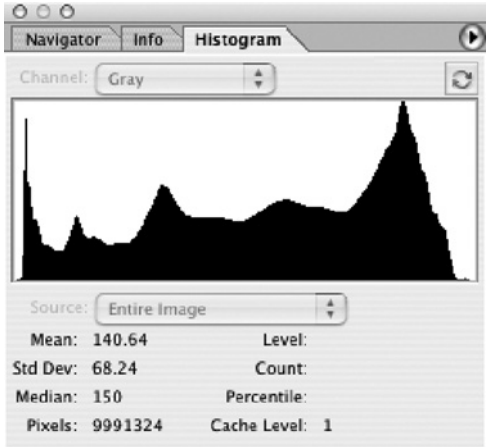
- Scanning: Capturing Images 121
- Image Correction 129
  - Adjustment Layer
- Printing with Digital Negatives 136
  - 1. Make 13-Step and 51-Step Grayscale Tables
  - 2. Create a File for Printing Tests
  - 3. Steps to Making Digital Negatives

Scanning: Capturing Images

Resembling traditional darkroom photography, a good negative is necessary to obtain good prints. Underexposed or overexposed negatives can create totally muddy prints. The image capture process in digital imaging is equivalent to getting good negatives—to acquire the most tonal information possible from the original material (negative, print, or digital camera capture). This does not necessarily mean traditionally "good looking" images. In fact, good image capture often results in somewhat flat contrast. I will cover the techniques to make "good looking" digital images on the monitor in the next section. At this stage of the digital imaging process, you need to make sure that you have the most tonal details, especially in shadow and highlight areas.

In order to achieve this goal, you need to understand digital imaging applications such as Adobe Photoshop®, various scanning applications, and raw file-processing applications. All these applications use a common method of representing tonal information of your image called a *histogram*.

The histogram represents the tonal data of an image in a linear diagram from dark to light tones and from left to right. The entire box is divided horizontally into 256 steps of tonal gradation. The left end of the box represents value 0, the darkest black, and the right end value 255, the brightest white. (Note that the white is not value 256. The total number of tonal variation is 256; 0 to 255 makes up 256 different tonal values.) All other tones in this image fall in between these two numbers. The following figures show you a grayscale image and a histogram.

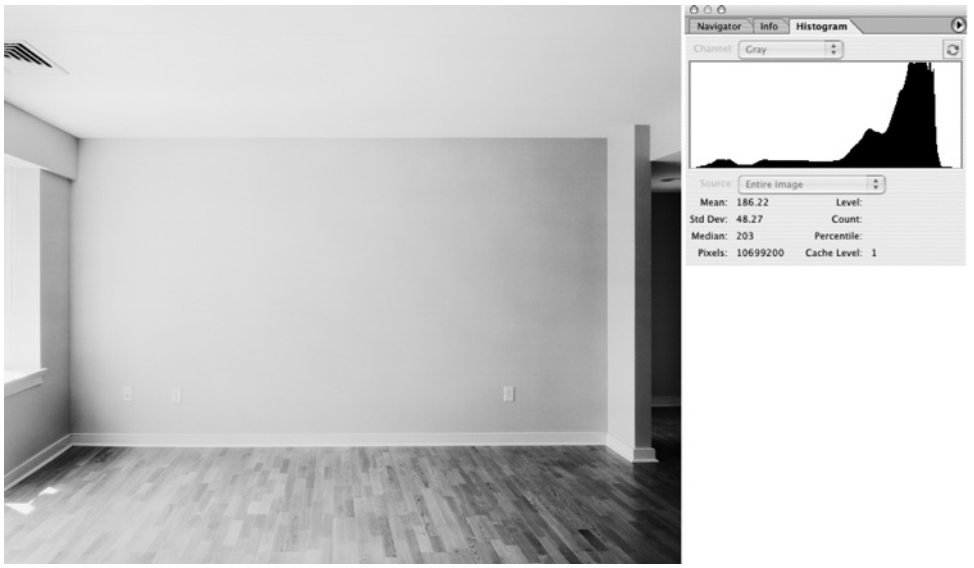


Histogram.

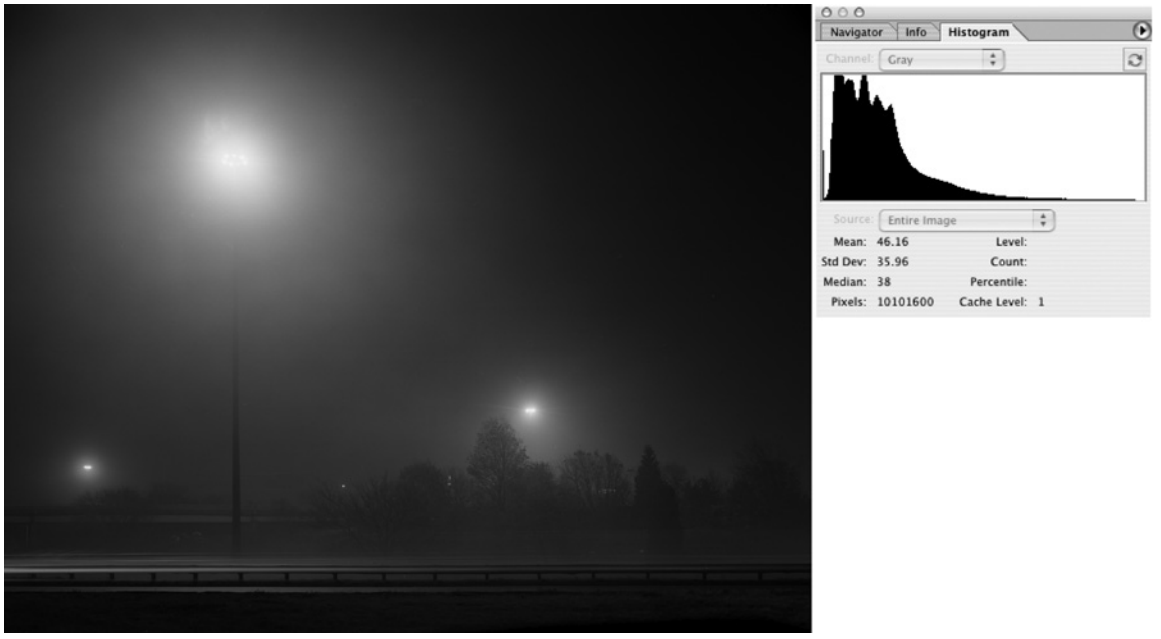


Gray scale image.

The mountain-shaped diagram you see in the histogram represents the number of pixels at any given tonal value. The diagram in this image begins to rise a little bit to the right of the left end at the value of about 10 and descend to the bottom at about 245. There is no peak going up at either end of the box. This means the image does not have any tone from 0 to 9 in the shadow areas and from 246 to 255 in the highlight areas. The darkest tone of this image is about 10 and the lightest about 245. At about value 180 the histogram shows the highest peak of the image, which means that 180 is the value most common in my image. Depending on different types of images you will have different graph shapes and location of peaks. If the image is hi-key the histogram will have a lump of high peaks toward the right since the image has a lot of high valued tones. The opposite is true as well—dark images will peak toward the left. Examples of both are shown in the following two figures.

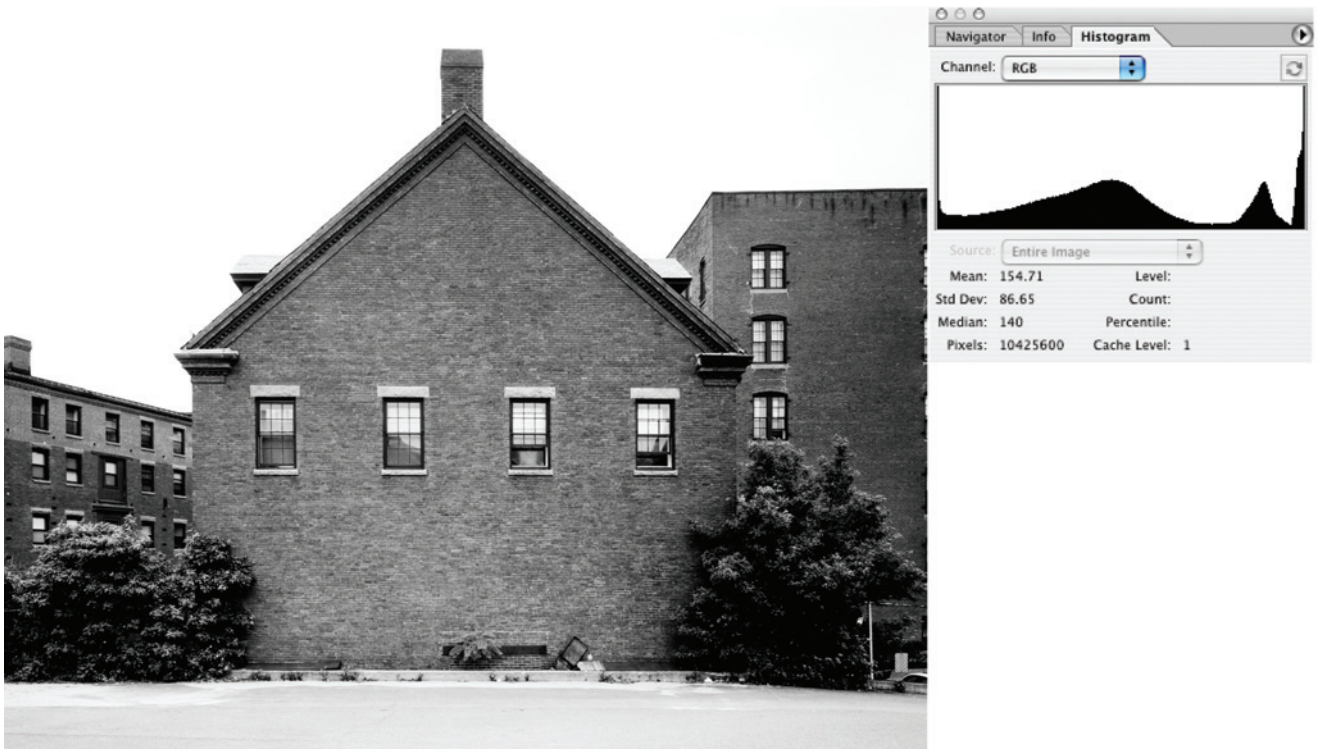


Example of hi-key image.



Example of low-key image.

To obtain a good image capture, you must avoid value 0 or 255 by controlling various tools in your image capture applications such as scanning software or digital cameras combined with raw file-processing applications. Having either 0 or 255 can mean that you lost tonal variation in the shadow or highlight area. Although many contemporary manufacturers take this problem into account when designing their image capture devices and software, automatic correction processes implemented in these devices often result in extreme values because it is an easy way of achieving high-contrast images, which many people consider to be "good looking," "clear," or "bright" (all arbitrary ways of describing the quality of images).



Example of image that has lost tonal details.

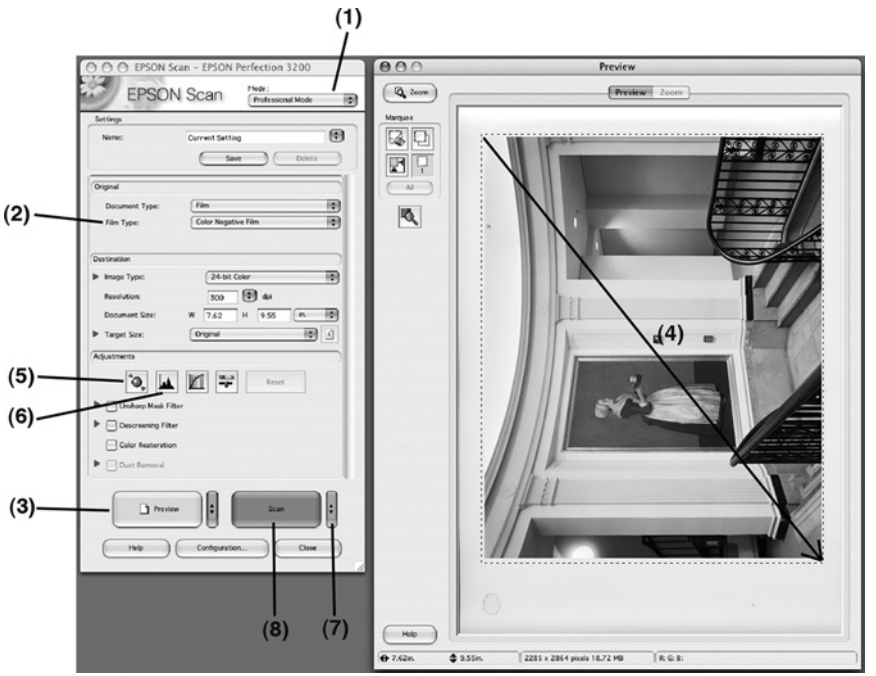
Although the first impression the image gives you is a clean, bright look, with a closer inspection you can find imperfect tonal details in the highlight and shadow area. The highlight area is washed out and the shadow blocked up so that it loses detail. Even though this effect may be desired for your aesthetic, it is not a good way to capture an image because you lose an option to create a different interpretation of the image. The bottom line is, once you lose the tonal variation in the capturing process, there is no way to resurrect the information unless you recapture the image. It might be okay

for some people to rescan the same negative several times, but in many cases it is a time-consuming task to do and sometimes costly if you are renting a high quality scanner, or impossible if captured directly by a digital camera.

With careful scanning you can control this important aspect of capturing by manually controlling the scanning software. When capturing with digital cameras, bracketing your exposure would be a good practice. In addition, most digital cameras have an on-camera histogram display of each captured image for you to double-check your exposure.

In the following procedure, I use an Epson flatbed scanner and a Nikon film scanner to demonstrate a good way of scanning.

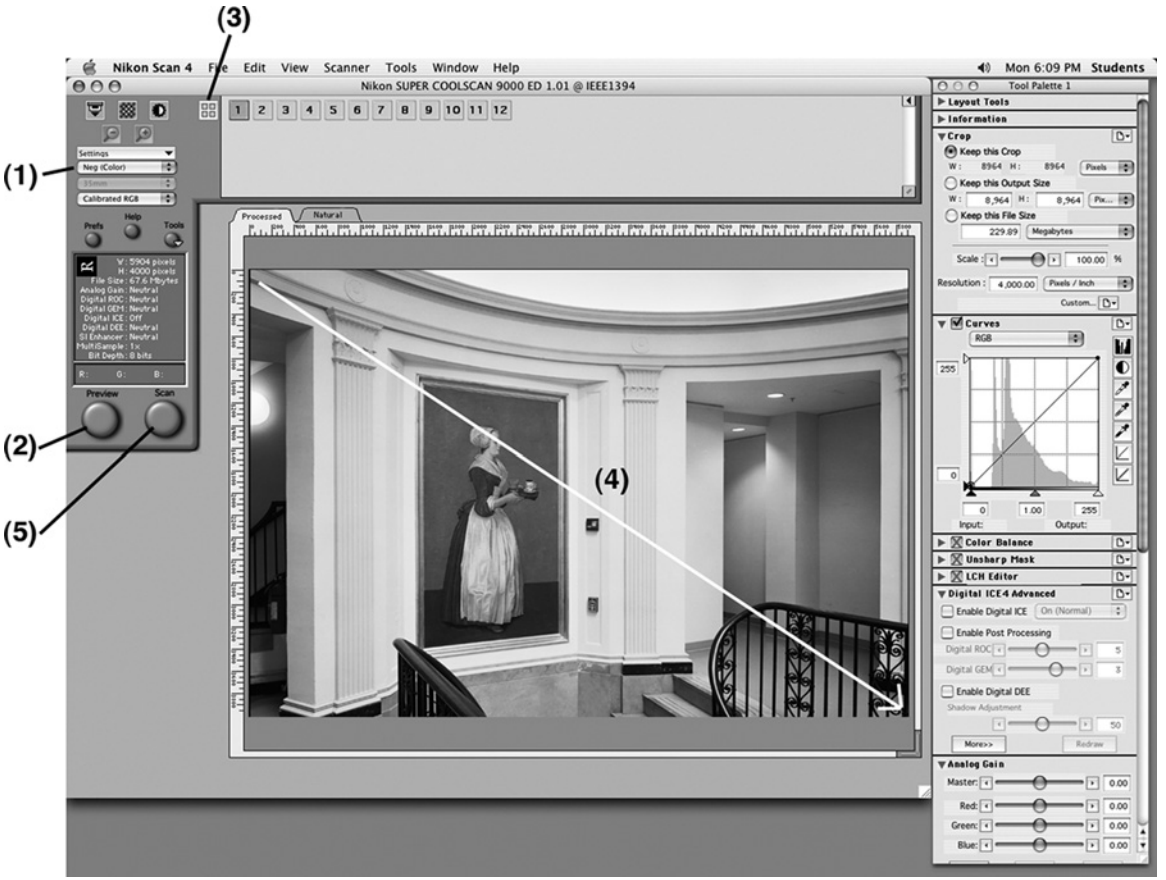
1. Open Epson Scan application.



Epson scan.

2. Set the correct application mode. If the window that opens doesn't look like the figure in step 1, it is probably because it is set with a different mode. Epson Scan gives you three different modes to choose from the pull-down menu at the top right corner of the window: Home, Office, and Professional Mode. Professional Mode is the only option that gives you full manual control over every aspect of your scanning, therefore, first set your scanner to Professional Mode.

If you are using different software, there may not be such an option. For example, Nikon Scan for Nikon scanners doesn't give you such an option. It has only one mode as shown in the figure with step 2.



Nikon scan.

3. Select the correct original type. (See (2) in the figure for step 1 and (1) in the figure for step 2.)

4. Preview scan. During this process, the scanner makes a quick inspection of your original to give you a screen view of the image. This process has nothing to do with specifics of your scan, such as resolution, file size, and bit-depth, rather, it simply shows you the original material on your screen. Most applications have a button called either "Preview" or "Prescan." Click this option to begin the scanning process. (See (3) in the figure for step 1 and (2) in the figure for step 2.)

Note: When you use film scanners that can scan a strip or an entire roll of film, you also need to be able to choose which negative or positive you want to scan. These scanners have a Thumbnail

scan button in the application window so that you can have small images to choose from. (See (3) in the figure for step 2.) Often double-clicking a thumbnail image automatically prompts a preview scan of the image.

5. Select the scanning area. Make a selection of the scanning area before you decide a resolution for your scan, especially when you plan to crop your image. The image size you are creating will establish the maximum size of your printed output and is determined by the resolution, at which you choose to scan and the size of the selected image area.

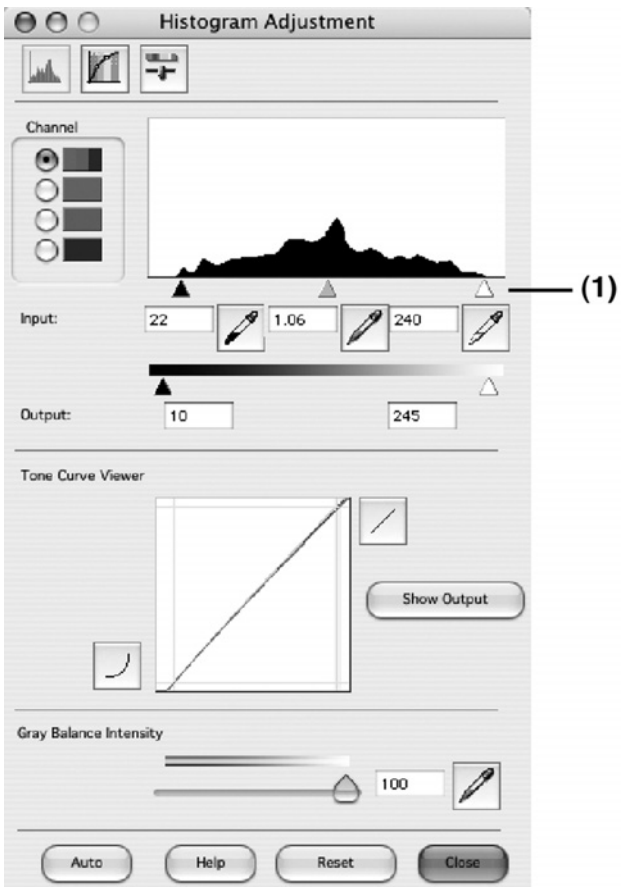
Even if you are planning to scan the entire screen view, select the actual image area because every scanner has to make a certain degree of automatic tonal adjustments, especially when you are scanning negatives. Therefore, you need to remove unnecessary information such as the orange base of color negatives. To perform this function correctly, scanners need to analyze the density of any given original. If it includes unnecessary areas such as the opaque mount of negative holders, it will not make a correct analysis, but will give you incorrect colors and tones. Make a selection by dragging your mouse from one corner to the diagonally opposite corner. (See (4) in the figures to both steps 1 and 2.)

6. Perform the automatic correction. Although it is our intention to control every aspect of the scanning process manually, built-in automatic correction functions of most scanners do a decent job in terms of correcting colors; it is the tonal information that this process tends to sacrifice. Automatic correction would be a good place to start your scan and in the next step you will resurrect tonal information that is lost by the process. Click the "Automatic Correction" button in Epson Scan. (See (5) in the figure to step 1.) Nikon Scan always performs the automatic correction, therefore there is no automatic correction button.

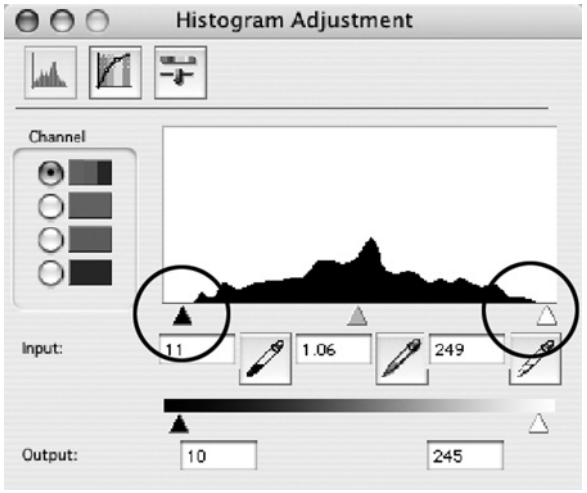
7. Correct manually. Most scanners give you a tool to manually control tonal information in highlight and shadow areas. The ability and options vary depending on the design of the application by each manufacturer.

Epson Scan gives you a powerful tool to control this aspect of the scan called histogram adjustment. Click the "Histogram Adjustment" button. (see (6) in the figure to step 1). It will open another window that looks like the figure to the left.

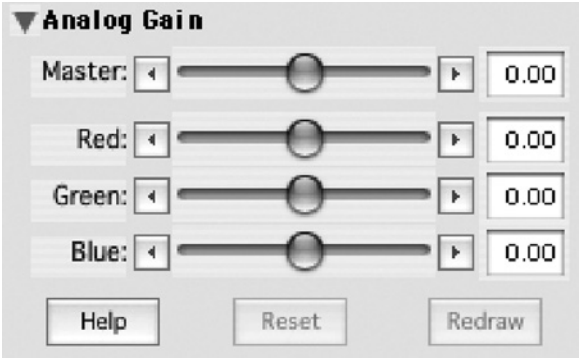
The entire rectangular histogram box represents the possible tonal range the scanner can cover. You can see that the histogram created from your preview scan takes only a small portion of the horizontal scale. This means that the density range of the original material is much smaller than what the scanner can do. On the bottom of the rectangular box are three triangular sliders colored in black, gray, and white from left to right (see (1) in the figure to this step). These sliders are the tools that allow you to control the range of tones you are going to scan from the original because the scanner will only assess the tonal range in between the black and the white sliders. Notice that the sliders are already near both ends of the histogram. If you use the mouse to drag these sliders away from where they are now and toward both edges of the box, you allow wider tonal ranges to be scanned, as demonstrated in the next figure. Leaving the sliders tightly close to the end of your histogram make the shadow darker and the highlight lighter creating a high-contrast image.



A histogram box.



Using the sliders to change the contrast.



Analogue gain option.

Unfortunately, you run the risk of losing some tonal details near the shadow and highlight area because any tones left outside the sliders will become total black or white. To prevent this loss of detail, I recommend you drag the sliders a little bit toward the end of the box. How much you drag them is up to your judgment. If you drag them too much, the resulting image will be too flat. It should look just flat enough to have all the tonal variations in shadow and highlight.

A Nikon scanner does not give you this kind of control. The application automatically determines the range. The only option for management is Analog Gain (see the figure to the left). However, it can only work for either highlight or shadow area. If the preview scan does not give you enough shadow detail, you can increase Analog Gain, but this will at the same time decrease highlight details and vice versa. There is no way to get both highlight and shadow details using this tool. The good news is Nikon Scan's automatic correction is not very severe and in most scans you will get good details in highlight and shadow.

8. Other correction tips. Scanners also provide you with additional correction tools such as curves and color balance. Although moderately using these tools in the scanning stage can be beneficial, Adobe Photoshop® offers most of these tools with much more sophisticated control. I will discuss these apparatuses in the following section. Once you learn how to use them, you can apply the same techniques at this stage as well.

Most scanners these days give you an option of scanning higher than 8 bits per channel. This option allows you to keep the smoothness of tonal gradation from breaking down and creating banding; this is called *posterization*. The range of bit-depth varies from 12 to 14 to 16. When you open any image scanned at higher than 8 bits in Adobe Photoshop®, it will automatically make the image 16 bits per channel. Although using higher bit-depth is beneficial to subtly gradated images, it makes the file size twice as large, and when you use Adobe Photoshop® later, the size grows exponentially until it becomes impractical to save the file. Also some Adobe Photoshop® tools and files will not work in 16 bits. Both Epson and Nikon scanners give you a choice of 8 bits per channel and 16 bits per channel. Choose 8 bits for general purposes such as our tests.

9. Check the resolution and size. Although you might be tempted to type in the printed output size and resolution to determine the size of your scan, there is a risk in doing so because each scanner has its physical limit for resolution, called the *optical resolution*. If you exceed the optical resolution, the scanning application will increase the file size by digitally adding more pixels. This process, called *interpolation* or *resampling*, results in degradation of the image quality. Avoid this process by finding out the optical resolution of your scanner (you can normally get this information in the specification sheet or user's manual of your scanner or on the manufacturer's website), and when you scan, make sure that you scan your image at the optical resolution or lower. However, this method leaves you without knowing what size output you can get. The following figure shows you the estimated file sizes for standard output sizes. You should type in a resolution in the scanning application and watch for the resulting size that matches or is larger than the desired output size shown in the following chart. Some acetate materials are produced in large rolls. Choose your output size based on this next table.

Print Size at 240 ppi (IN.)	4 × 5	5 × 7	8 × 10	11 × 14	16 × 20	20 × 24
File Size of Grayscale Scans at 8 bits (MB)	1.1	1.92	4.39	8.46	17.6	26.4

Estimated file sizes.

For example, if you want to make a 16 × 20 in. or smaller print from your scanned image using an inkjet printer, the chart tells you that you need at least a 17.6 MB file. After a preview scan and making a selection, you would type in any resolution that is smaller than or the same as the optical resolution of the scanner. I suggest you type in the optical resolution to begin with and see what size file it will create. Although it seems like a good idea to scan all your images at the optical resolution, many scanners these days provide you with a high-optical resolution that can make too large a file to handle. If the size you would acquire is too large, then reduce the resolution by typing in a smaller number, not by changing the image size. In addition, check the size again. This way you can keep track of the scanning resolution. Repeat this procedure until you get the right size. It does not have to be exactly the same as the size noted in the above chart. To allow some wiggle room for additional cropping or to factor in different proportions for the image, I suggest you aim at the size that is about 10% larger than the size you want.

10. Make a scan. By clicking the "Scan" button you will produce an actual scanned image. Epson Scan automatically saves your scan as the image is being scanned. The File Save Options window allows you to choose a folder and to select a file format of the image. (See (7) in the figure to step 1.) I suggest you always use TIFF format for printing purposes. Nikon Scan will open an image after completing a scan. You can then save the image as a TIFF file.

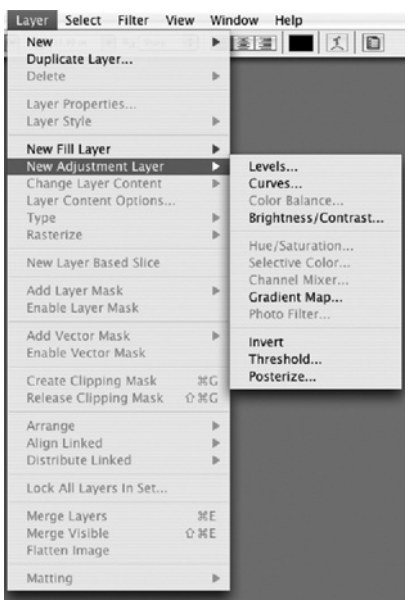
Click the "Scan" button on both Epson Scan and Nikon Scan software to make a scan. (See (8) in the figure to step 1 and (5) in the figure to step 2.)

Image Correction

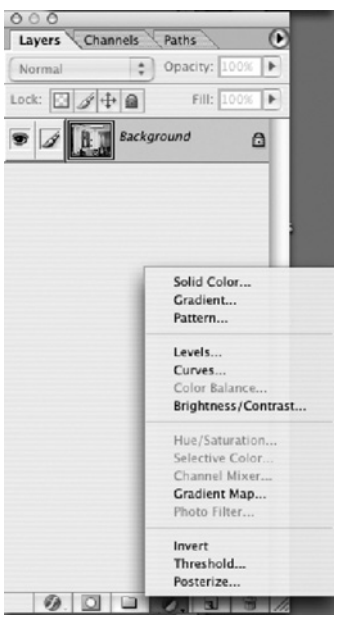
Although image correction can be elaborated with many details and examples, I will try to keep this section to only essential concepts and tools necessary for making digital negatives. There are many good books on this subject already published. Should you want to examine image correction more, one of my favorite books is *Real World Adobe Photoshop CS2: Industrial Strength Production Techniques* by Fraser and Blatner (see Annotated Bibliography).

Adjustment Layer

One of the most important features of Adobe Photoshop®'s image editing system is the use of layers. One type of layers is called the *adjustment layer*. This layer does not contain physical information about your image but only adjustment information. This allows you to keep the original data intact no matter how many steps of adjustment you apply to the original image, which is a great advantage because any correction applied to the original image is destructive to the integrity of the tonal gradation. By using adjustment layers you can minimize degradation of tonal data. If you keep applying new corrections successively to your image, it will start losing some of the tones that are essential to keeping the smoothness of tonal gradation, and will result in banding and/or posterization. Adjustment layers keep the correction separate from your original data (usually named as the background layer) and make it possible for you to re-adjust existing corrections and apply multiple corrections as one correction at the final moment. You can access these layers either by going to the Layers menu and choosing Adjustment Layers followed by the options described below, or you can click the "Adjustment Layer" button at the bottom of the Layers palette. (See the following two figures.)

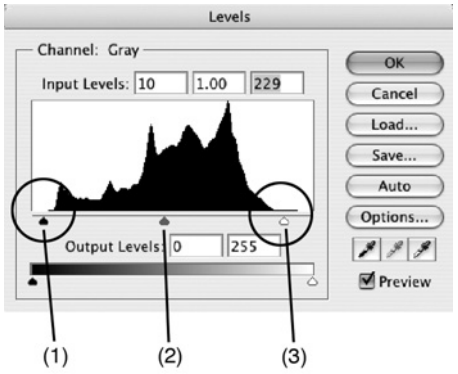


Layers menu.

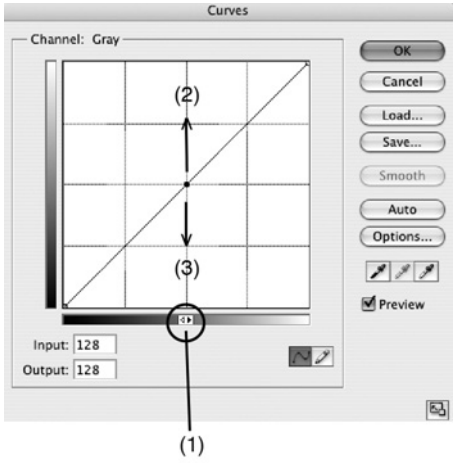


Layers palette.

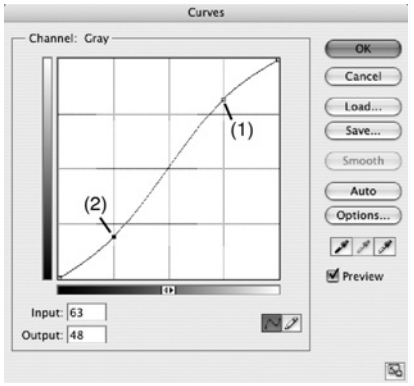
There are many different options to choose from. I will only discuss two *levels and curves*, which are essential to tonal correction techniques.



The levels adjustment.



The curves dialog box.



Contrast control #1: increasing contrast.

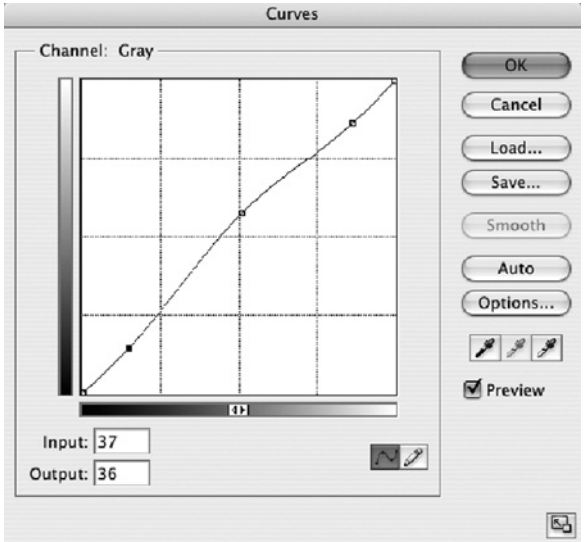
1. Make the Levels Adjustment. Once you open the Levels Adjustment, you will notice that it looks very similar to the Histogram Adjustment of Epson Scan. In fact, both use exactly the same information with a slightly different function. Use this tool to readjust highlight and shadow values by dragging the white and/or black sliders in the input box. If your scan is made correctly, you don't really need to use the output box. Make sure both sliders stay slightly outside the histogram. (See (1) and (2) in the figure to the left.) Use the middle slider to control the overall brightness of your image (See (3) in the left figure.)

2. Use the Curves Adjustment. The Curves Adjustment layer allows you to control the brightness and contrast of your image. Although it does not show you the actual histogram of your image, it represents your image linearly from shadow to highlight, just like the Levels Adjustment layer. By clicking the middle section of the gradation on the bottom of the square box you can change the direction of shadow to highlight progression to either from left to right or vice versa. (See (1) in the following figure.) I suggest you use the left to right orientation to keep it consistent to Levels. To make the image brighter you can click and drag in the middle of the diagonal line upward. If you make the point at the exact center of the line and drag it upward, you will create the same effect as moving the middle slider in the Levels layer to the right. (See (2) in the following figure.) To make the image darker drag the curve down. (See (3) in the following figure.) You can also notice that as you drag the curve, the entire diagonal line changes its shape. Even though you used one point at a specific tone, Adobe Photoshop® automatically figures out how other tones around should change to keep the smoothness of the tonal scale.

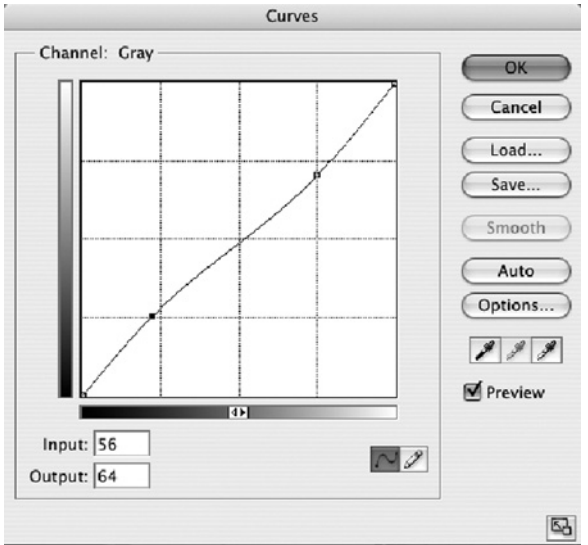
For example, even if you click on a point in the shadow area of the curve and drag it up so as to achieve more detail in a dark tone, you can see that the middle part of the curve has also gone up and makes the entire image lighter. The Curves Adjustment layers allow you to use more than one point so that you can control different tonal areas separately. This does not mean that it allows you to change tones in an isolated area, such as dodging and burning techniques in the darkroom. {To be able to do this, you need to learn another feature of Adobe Photoshop® called *Layer Masks*, which I will discuss later.) However, you can perform a contrast control of your image using this capability like using a filter in the black-and-white darkroom. After all, to increase contrast means to make highlights brighter than the original and to make shadows darker, which is how an image with strong contrast looks. To decrease contrast means to make highlights darker and shadows lighter. And as a result, a low-contrast image will show many middle gray tones.

To make an image high contrast you can click on a point somewhere in the highlight area (for instance, somewhere in between the center and the top right.) and drag it up. (See (1) in the figure to the left.) Then click on another point in the shadow area and drag it down. (See (2) in the figure to the left.) Use the *Preview* button in the Curves dialog box to compare the image with and without the change. Readjust the position of the points either up and down or left and right to fine-tune the contrast. If it looks fine, click OK in the upper right corner of the Curves dialog box. You can also use more than one Adjustment Layer. Try not to make too complicated a curve; limit the points to less than four or five because you want to keep the curve as simple as possible in order to keep the natural tonal progression.

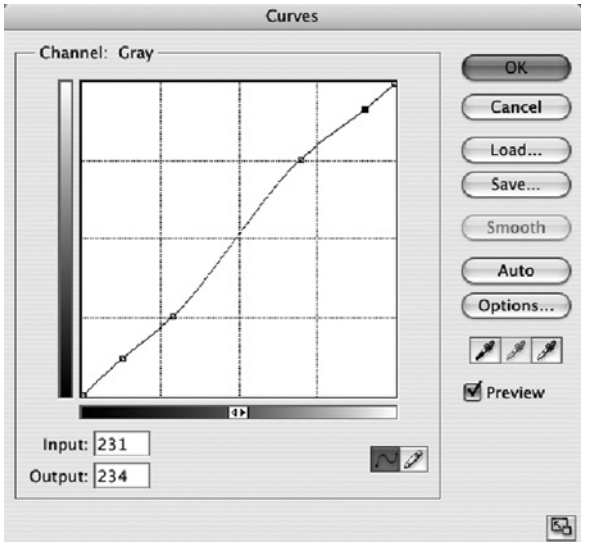
The following figures show you different types of curves.



Contrast control #2: decreasing contrast.

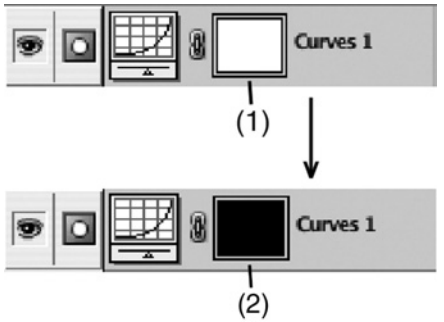


Contrast control #3: brightening midtone without changing highlight and shadow.



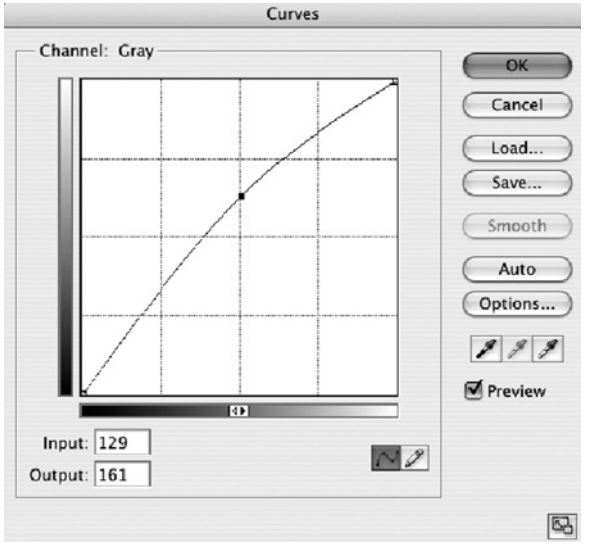
Contrast control #4: increasing contrast without changing highlight and shadow.

3. Add Layer Masks. To isolate adjustments to a specific area of an image, which is equivalent to dodging and burning in a traditional darkroom, you need to use another great feature of Adobe Photoshop® called *Layer Masks*. Although there are tools like dodging and burning in the tool box, using such selections is not helpful because these tools permanently change your original tonal data in the background layer. Instead, you can use the same adjustment layers such as Curves and utilize the layer masks that are already in the adjustment layers. The mask options are indicated as blank white boxes in each adjustment layer. (See (1) in the following figure.) Although they are initially white, which has no effect on your image, if you fill black in the layer mask, you will completely block your adjustment from showing its effect as though you turned off the eye of the adjustment layer. (See in the figure below.)



Layer masks.

Make a Curves Adjustment layer and drag the curve up to make the image lighter. Click OK to close the dialog box.



Curves adjustment layer.

Click once on the Layer Mask to make sure it is activated.

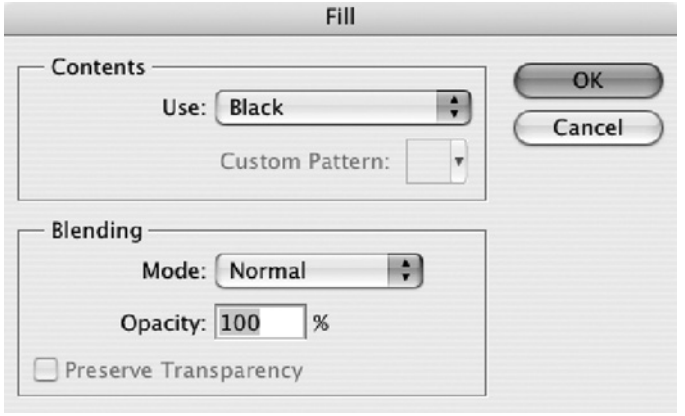


Then open the Edit pull-down menu on the top menu bar and choose “Fill”.



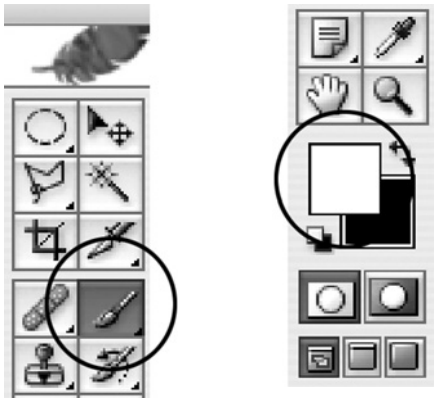
Edit Pull-down menu.

In the dialog box that appears, choose "black" in "content" and leave the opacity 100%. Click OK, and immediately your adjustment on your image will disappear. You can also see that the layer mask turned black on the layer palette. Now by making the black layer mask partially white or gray, you can make the adjustment reappear only in the area where you want. You will use the *Paint Brush* to do this.



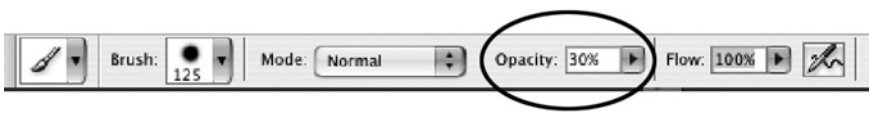
The dialogue box.

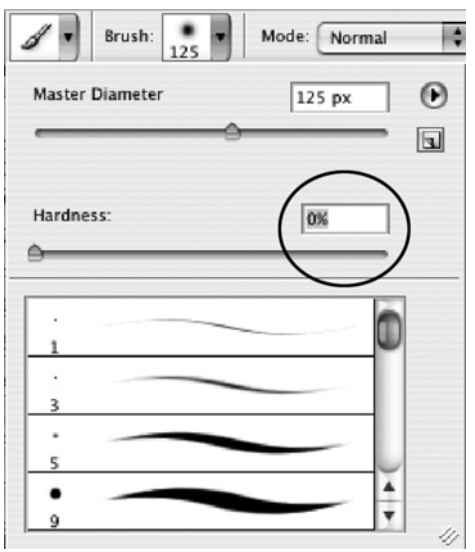
In the tool box on the left side of the screen, choose Paint Brush. Make the foreground color white by clicking the small black-and-white square on the corner and switching between foreground and background colors.



The toolbox and foreground/background colors.

At the top option bar, set the opacity of the brush at around 30%, set the hardness of the brush at 0%, and change the brush size in the brush control menu until it is large enough to cover the area you will lighten up with a few brush strokes by using the brush control menu.





The brush control menu.

Move the mouse to the area of the image you want to lighten and start making strokes by click-and-dragging. Frequently check the difference by turning on and off the eye icon of the layer in the layers palette. You will see the area you are stroking with the brush getting lighter as if you were dodging in the traditional darkroom.



The eye icon.

You will use exactly the same technique for burning except for the Curves Adjustment itself. To burn an area of the image, make your initial curve so that the image appears darker. Then follow exactly the same step as the dodging technique described above.

Printing with Digital Negatives

Although I will use cyanotype as a primary process in my explanation of making digital negatives, the techniques explained in this chapter can be used for other contact printing processes, such as Van Dyke brown prints, Platinum Palladium, Gum Bichromate, and Casein among many.

In the traditional darkroom processes, tonal control of the cyanotype print is achieved by using various exposure times and chemical solutions. In the digital negative process I do not recommend changing exposure times or chemical solutions to control print density; instead you can achieve a more sophisticated degree of tonal control by changing the density of the negative itself. In order to limit the variables, you will have to choose a combination of exposure time and chemical solution and keep it for the entire process.

Before making a digital negative, I recommend you go through the scanning and image correction processes described in the previous sections so that you have a "good looking" image on the monitor. The corrected image can be inverted to a negative in the digital printing stage and printed out on a clear substrate material. The density of the negative produced by inverting a positive image without any adjustment does not normally create a full tonal scale, although the resulting prints can vary depending on different techniques and materials you use. In making digital negatives, readjusting the density of each negative for each combination of method and material is the crucial step to achieve a full tonal scale in printing.

The following two figures show a digital image scanned from a 4 × 5 negative and corrected in Adobe Photoshop®, and the resulting prints made with the cyanotype process from a negative directly inverted from the file and printed on a sheet of Pictorico OHP film.



Scanned image.



Cyanotype made from scanned image, inverted and printed as a negative on HP.

The highlight on the top portion of the print is mostly washed out due to the high density of the negative; the midtone and the shadow areas look too dark because of the low density. This appearance means that the cyanotype process is not capable of producing the full tonal scale from the negative made by inverting a "good-looking" image, due to the harsh density range that the printer and the substrate used in this test. You might say that it is somewhat similar to the typical cyanotype made from a traditional silver-based black-and-white negative. However, the ability to control density of the digital negatives makes it possible to produce a full tonal scale print. The following figure is the final versions of cyanotype print made from the same original image but completed after adjusting the density and reprinting negatives several times, and testing each negative in the cyanotype technique.

In order to achieve a full tonal scale in your prints you need to go through a series of test prints until you create a good density adjustment curve using Adobe Photoshop®'s *Transfer* function. Once you achieve the right adjustment, the curve can be used for other images on similar paper with the same technique. In the following procedure I will explain how these experiments are accomplished step-by-step. Note that the numbers I came up with in the following test are only true when the same material and conditions are used later. Each choice of paper, chemicals, type of exposure unit,



Final cyanotype from corrected negative.

and the amount of exposure, as well as the choice of inkjet printer and substrate, can all change the result. For this exact reason I recommend everyone do his or her own tests.

The following list shows you the fixed variables that I used in this test: Paper: Arches Platine; chemical solution: Bostick & Sullivan Cyanotype A and B; exposure unit and time: The one described in Chapter 4, 20 minutes; Substrate: Pictorico OHP film; printer: Epson Stylus Photo 2200 inkjet printer with Color and Photo Black ink. (Any dye-based or pigment-based inkjet printer would work fine, but different printers can produce different density negatives from the same file. Keep using one printer throughout the test.); and substrate: Pictorico OHP film.

1. Make 13-Step and 51-Step Grayscale Tables

In order to be able to make more accurate decisions on density control of your negative, I recommend you make two grayscale step tablets: one divided in 13 steps and the other in 52 steps.

To make a 13-step table in Adobe Photoshop® CS:

1. Go to File > New in the top menu bar.

2. Make a file in 2 × 13 in. (5 × 32.5 cm) with 240 pixels per inch (ppi) resolution in Grayscale mode.



3. Go to View > Show > Ruler from the menu bar.

4. Go to View > Show > Grid from the menu bar.

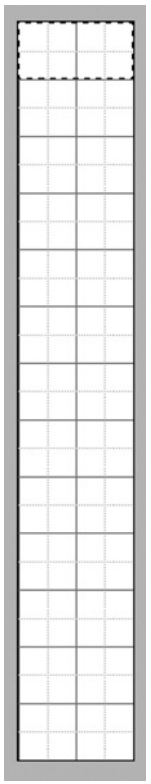
5. Go to View > Snap > Grid from the menu bar.

6. Choose the rectangular Marquee tool in the tool box.

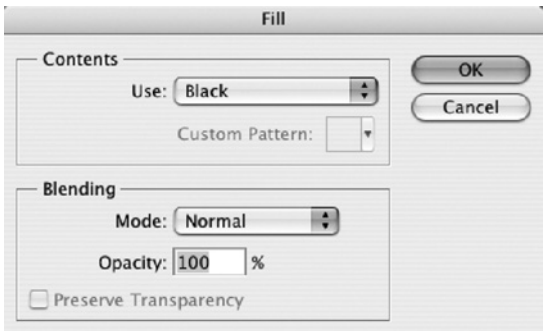
7. Click and drag a rectangular box at the size of 2 × 1 in. (5 × 2.5 cm) at the topmost portion of the image (see figure at left).

8. Go to Edit > Fill in the menu bar.

9. Choose "Black" in "Content" and make "Opacity" 100% and click OK.



Rectangular box



10. Move the rectangular marquee selection down 1 in. by dragging the selection.

11. Go to Edit > Fill again.

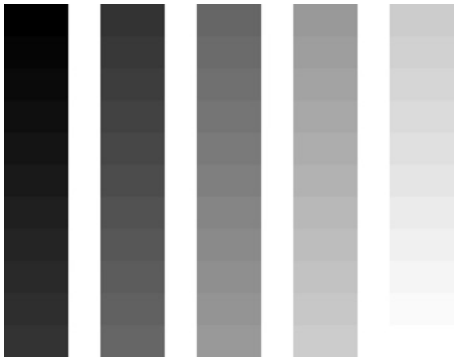
12. Choose "Black" in "Content" and make "Opacity" 95% and click OK.

13. Repeat steps 10–12 and change "Opacity" in step 12 so that you create tonal steps that are 100%, 95%, 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 5%, and 0%.

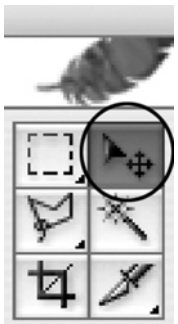
14. Go to View > Show > Grid from the menu bar and uncheck Grid to turn off the grid.

15. Save the file. The following figure is the resulting image.

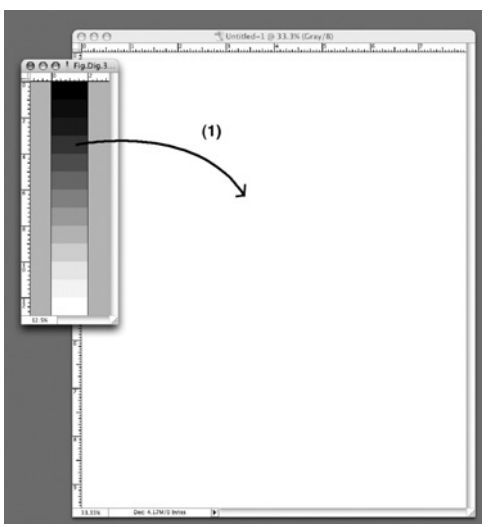




A 52-Step table.



The move tool.



Dragging the 13-step image.

To make a 52-step table you can use the same procedure as the 13-step table and use the file size 14 × 11 in. (35 × 27.5 cm). The left figure is the final image of a 52-step table.

2. Create a File for Printing Tests

1. Open both the 13-step and 51-step grayscale files.

2. Open the image you want to make prints of.

3. Go to Image > Duplicate in the menu bar to duplicate the image file.

4. Go to Layer > Flatten.

5. Go to Image > Image Size and make the file size about 5 × 8 in. or smaller at 240 ppi.

6. Go to File > New and make an 8 × 9½ in. at 240 ppi file and name it "Test_01", as shown below.

7. Choose the 13-step table file by clicking on it but make sure the "Test_01" file is visible in the background. (See Fig. Dig.3.10.)

8. Go to Image > Image Size and type "4" in Height and "240" in Resolution.

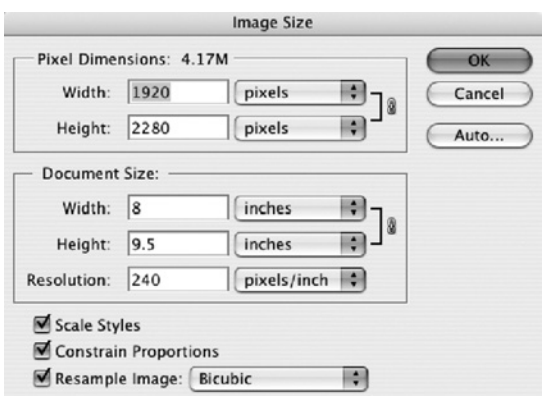
9. Choose the Move tool in the tool box.

10. Click in the middle of the 13-step file and drag over to the visible area of the Test_01 file. (See (1) in figure to the left.)

11. The Test_01 file will now be on the foreground with the 13-step image copied. Drag the 13-step image to the top right corner.

12. Choose the 52-step file and repeat steps from 7–11.

13. Choose the image file and repeat steps 7–10.



The page setup.



The final image with 13-step and 51-step tables.

14. Your final image should look like the figure to the left.

15. Save the file.

3. Steps to Making Digital Negatives

The First Negative

1. Open the Test_01 file in Adobe Photoshop®.

2. Go to File > Page Setup in the menu bar.

3. Choose the size of paper the same as your acetate and set the orientation according to your image orientation.

4. Click OK.

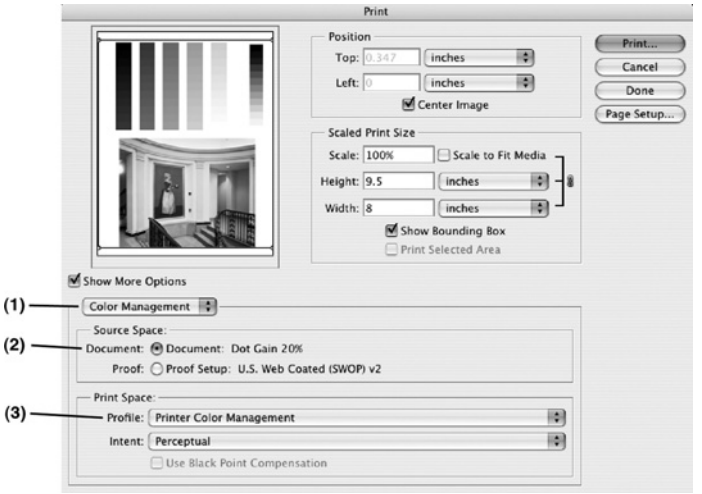
5. Go to Image > Image size.

6. Check the *Constrain Proportion* and *Resample Image* checkboxes. Then, make Width or Height smaller than your substrate size and set Resolution at 240 ppi.

7. Click OK.

8. Go to File > Print with Preview in the menu bar.

9. Check the "Show more …" checkbox and change the pulldown menu to "Color Management." (See (1) in the figure below.)

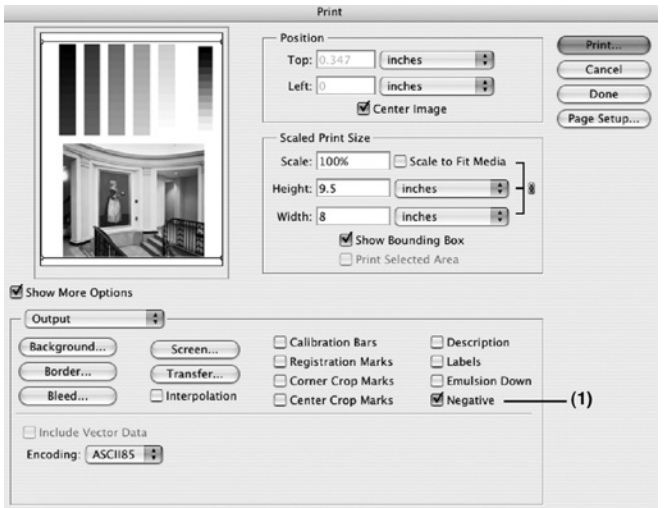


10. In *Source Space*, check the radio button next to "Document." (See (2) in the above figure.)

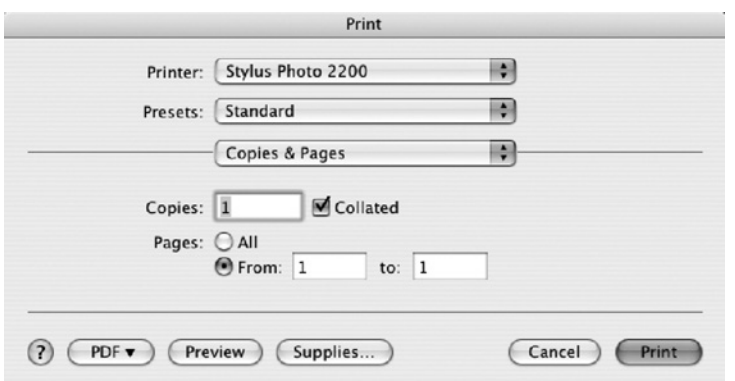
11. In *Print Space*, change the pulldown menu to "*Printer Color Management*." (See (3) in the figure above.)

12. Change *Color Management* to *Output*.

13. Check *Negative*. (See (1) in the figure below.)

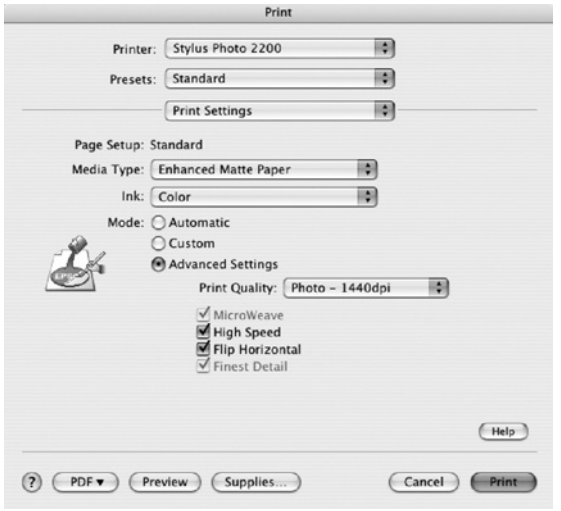


14. Click *Print* on the top right corner of the dialog box. You will get another dialog box as shown in the following figure.



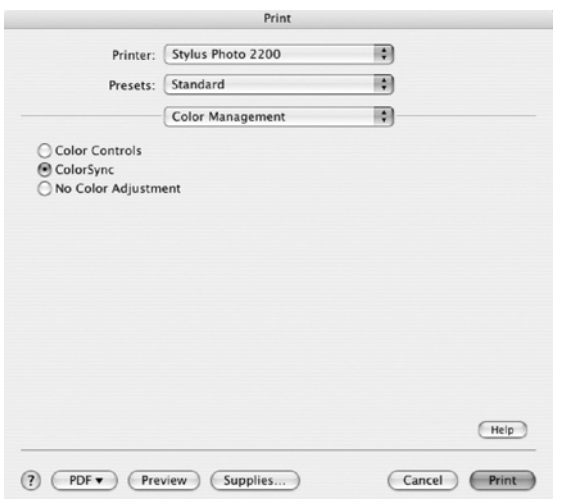
15. Change *Copies & Pages* to *Print Settings*.

16. Set this dialog box as the following figure.



Make sure you keep these settings throughout the entire test procedure. Different settings will produce different densities of negatives.

17. Change *Print Settings* to *Color Management*.



18. Check *Color Sync*.

19. Make sure you correctly inserted your substrate in the printer and click *Print* on the bottom right of the dialogue box.

20. After you have printed the negative, make a cyanotype in the darkroom. The resulting print will look like the following image.



A cyanotype from the first negative.

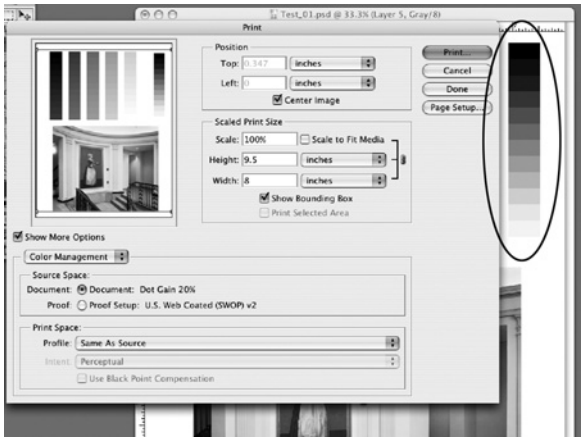
The Second Negative

The cyanotype made with the initial negative will normally lack highlight and shadow details as shown in the figure above in step 20. You can see that the tonal progression is concentrated in a very narrow tonal area of the original grayscale. This initial print will be used to readjust tone and create a second negative that can expand midtones so as to reproduce a full tonal variation. Follow the steps below:

1. Open *Test_01* file if you have closed it and make sure the 13-step table is visible.

2. Go to File > Print with Preview in the menu bar.

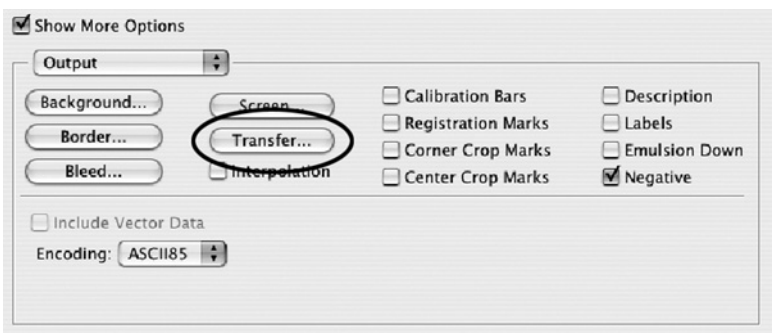
3. When the *Print with Preview* dialog box appears, move it over so that you can see the 13-step table in the background.



Print with previous dialogue box.

4. Choose *Output* if it is not already chosen. (See step 12 in "The First Negative" procedure.)

5. Press the *Transfer* button as shown in the next figure. It will open another dialog box that looks like the dialogue box illustration below. Make sure again that the 13-step table is still visible.

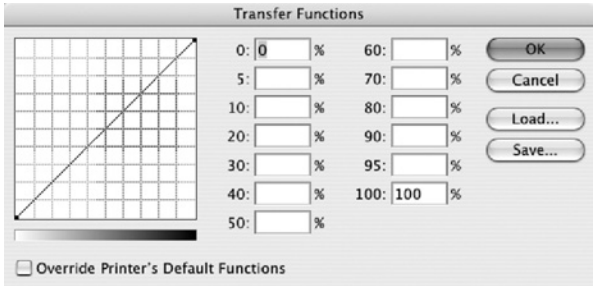


The transfer button.

6. Look at the initial cyanotype print and find the closest value in the print that matches the density of 5% in the 13-step table in the screen. In my example, 12% in the print was a little too light and 14% too dark. I took a guess that it is 13%.

7. Type the value (13%) in the 5% section of the Transfer dialog box.

8. Repeat steps 6 and 7 for each percentage of the "Transfer" dialog box. The initial cyanotype print is often very compressed in tone and it may not be easy to find the matching tone for each percentage. Try to find the 5%, 10%, 95%, 90%, and 50% first and then move on to other percentages. It is okay to approximate some of the values.



9. When you are finished, click OK.

10. Print another negative in the same way as the procedure for the first negative. The only step you added to the first negative printing is the Transfer correction.

11. Make another cyanotype with the new negative.

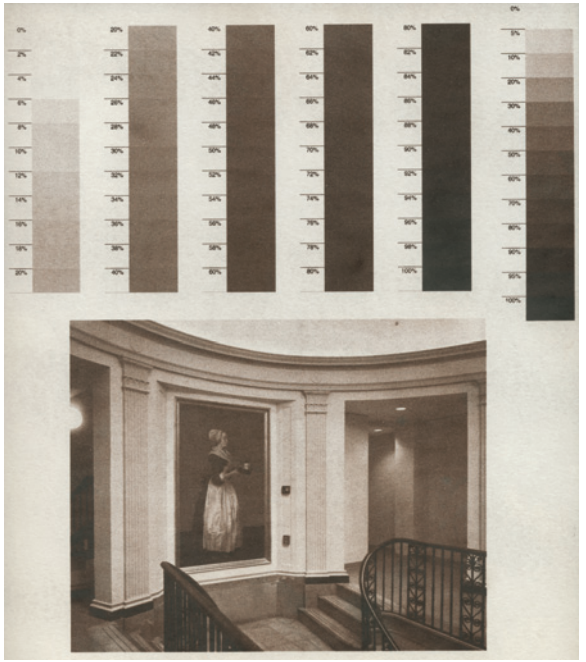


A cyanotype from second negative.

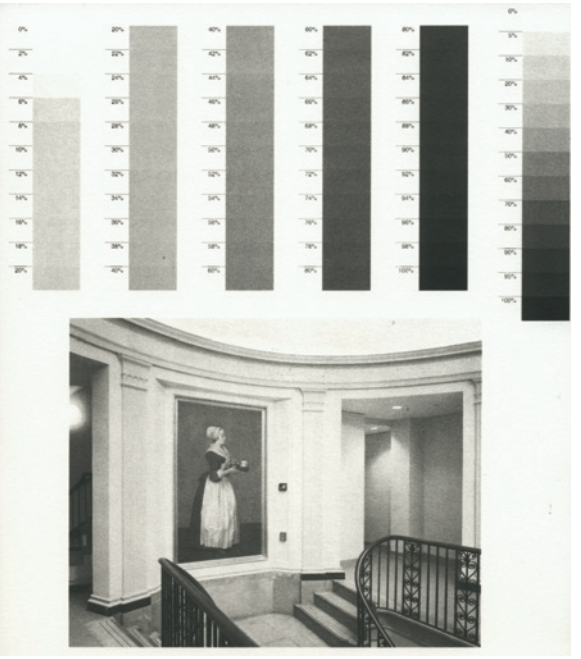
12. If the print reproduces all tonal variations, you can make the final print using the same Transfer dialogue box with another negative at the size you would like to print. You will type in the same values in each percentage in "Transfer" as the values that you came up with from the steps 7–12.

13. If the print still needs more density corrections, go back to the Transfer dialog box, readjust the percentages, and make another negative and another cyanotype. Repeat this process until you make a satisfactory print. The figure on page 138 is my final print.

You can use the same process with other printing techniques such as Van Dyke brown and palladium. The following two figures are the final prints of each technique. I used the same paper and acetate; the exposure time was 10 minutes for the Van Dyke brown process. For the Palladium process I used the delution #3 and a 6-minute exposure.

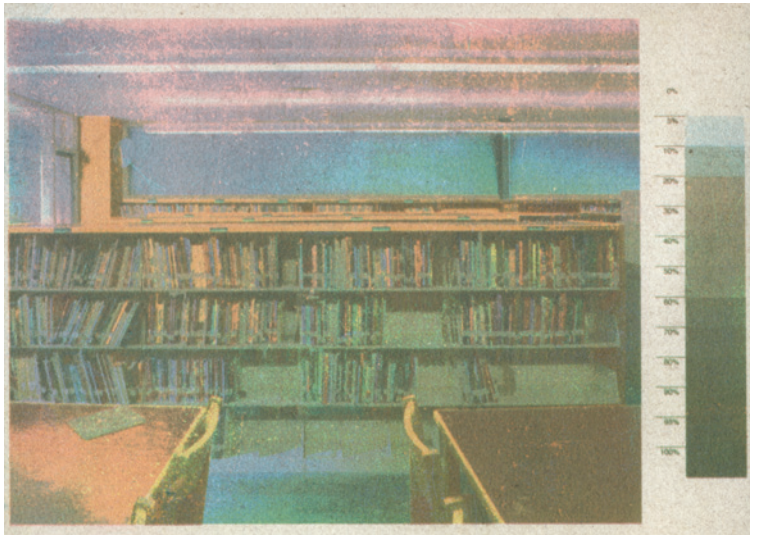


A Van Dyke brown print.



A palladium print.

Below is the three-color-gum print I created. Although making proper color-separated negatives took patience, I found that the resultant print was more satisfactory if I intensified the color saturation of the scan. Then, I created each cyan, magenta, yellow, and black (CMYK) negative by copying each channel of the CMYK color image into a grayscale file. The watercolors to use for gum printing are described in Chapter 9.



Three-color gum print.

Part III

Light-Sensitive Methods

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8 Van Dyke Brown Prints 168

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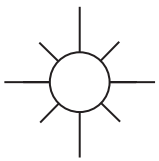
11 Platinum and Palladium Printing 210

12 Bromoil Printing, by Gene Laughter 226

13 Enlargement Emulsions 240

14 Contemporary Daguerreotypes (Becquerel Process), assisted by Tyler Treadwell 252

15 Alternative Color Exposure and Printing Processes, by Juliana Swatko 264



Daylight



Subdued Light



Safelight



Protective Gloves



Respirator



Protective Goggles



Anna Atkins. Section title page from presentation album, *Cyanotypes of British and Foreign Flowering Plants and Ferns,*
35 × 24.5 cm cyanotype, *circa 1851–1854*.
Courtesy of Hans P. Kraus, Jr., New York.

Chapter 7

Cyanotypes

- Materials 152
- Making the Stock Solution 157
- Making a Cyanotype 158
- Cyanotype on Fabric 162
- Toning Cyanotypes 165

Cyanotypes, or *blueprints,* are light- to deep-blue images that can be inexpensively printed onto paper and fabric. Properly made, cyanotypes are permanent and can be combined with other hand-applied emulsions as well as traditional artists' pigments and pastels. They tend to exhibit less middle tones than other processes described in this book but using the directions in Chapter 6 will overcome this characteristic.

British astronomer and scientist Sir John Herschel (my personal hero, who, in 1819, discovered and freely shared how to "fix" silver-based photos with sodium thiosulfate—the fixer used to this day—and is reputed to have coined the terms *positive, negative*, and *snapshot*) is credited with discovering blueprinting, or heliography with iron salts, in 1842. Calling the process "ferro prussiate," he later used cyanotypes to reproduce his intricate mathematical tables. Soon afterward, Anna Atkins, an accomplished scientific draftsman, botanist, and the first female photographer, was taught the cyanotype process by her friend Herschel. She recognized photography's potential for book illustration when she lifted cyanotypes out of the mathematical sphere with her impressions of algae. Her *Cyanotypes of British and Foreign Flowering Plants and Ferns* is the first book of photographic illustrations and the first to use photos with text (although it was printed in installments from 1843–l854) and the first photographic science book. More of her work can be seen in *Sun Gardens: Victorian Photograms* by Anna Atkins (see Annotated Bibliography). By 1880, blueprinting was used for duplicating engineering and architectural drawings. At the turn of the century, Henry LeSecq blueprinted photographic images of Gothic structures in Paris for the French government. Clarence White, a member of the British Pictorialist photography group called Linked Ring, also made cyanotypes.

Until recently, architects and engineers made blueprints or *diazo prints* on precoated paper, which they exposed through drawings done in pen-and-ink on tissue paper, vellum, or acetate. This precoated paper was not permanent and usually had to be processed in ammonia fumes, which can cause lung problems. Although large photocopy and digital printers are taking over the job that diazo machines used to do, the user of this book might be inspired by the technique of drawing on transparent or semitransparent materials.

Safety

If potassium ferricyanide comes in contact with heat higher than 300°F (147°C) or concentrated acids, such as stop bath, a poisonous hydrogen cyanide gas will be released. Therefore, exposure to ultraviolet light should not be done with sunlamps, where the glass can heat up and actually melt negatives.

Both ferric ammonium citrate and potassium ferricyanide are toxic, so wear protective gloves when using these chemicals, and wear a protective mask when handling them in the powder form. Never ingest chemicals.

Never mix ammonia (e.g., ferric ammonium citrate) products and bleach, since the combination produces lethal fumes.

Disposal of even small amounts of cyanide, found in potassium ferricyanide, should be handled by waste disposal companies or household hazardous waste programs, usually available free or at minimal cost to noncommercial photographers. Most universities and public schools also employ such a service. John Basye, formerly of Blueprints/Printables (see Supply Sources), says that local sewage treatment plants want to know when effluent contains cyanide and may wish to test the quantity of cyanide occurring in your household wastewater. Most fire departments also want to know the type and location of chemicals stored in your home.

Do not pour solutions in the ground, into septic tanks, or down a storm drain. If there is more than one cup of blueprint chemistry to dispose of, evaporate it to a much smaller quantity, which you can label and take to a hazardous waste area.

Clearly label bottles and keep them out of the reach of children and pets.

Method Overview

1. Paper or fabric is coated with liquid yellow cyanotype solution (a combination of two iron-based chemicals and water).

2. An enlarged negative or object is placed on top of the coated surface. Ultraviolet light shines through the clearer parts of the negative or around the object and hits the coating, reducing some of the ferric salt of the ferric ammonium citrate to the ferrous state and then combines with potassium ferricyanide, which turns the coating blue.

3. The negative is removed. The paper or fabric is developed in water, where the unexposed chemicals wash off to reveal the receiver. The exposed areas remain blue.

4. As the emulsion dries, it slowly oxidizes to a deeper blue.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio, and Chapters 5 and 6 about making negatives.

1. Image. You will need a negative transparency the same size as the positive print you wish to create. Bear in mind that cyanotype is a contrasty process (there are fewer tones than a black-and-white photograph), and some detail can be lost. So negatives with a wide range of gray and black will reproduce with less separation in the blue shadows and midtones of the print. However, Chapter 6, "Making Digital Negatives," describes a method to tailor negatives for rendering an impressive tonal array. You can also create analogue negatives, as in Chapter 5, specifically for cyanotypes by testing and remaking them.

2. Chemicals. You will need potassium ferricyanide, available at most photography stores, and ferric ammonium citrate (green anhydrous), a special-order item from one of the merchants listed in the

Supply Sources. Do not use brown ferric ammonium citrate. Store raw and chemical solutions separately in a dry place with tops on bottles tightly capped. Photographer's Formulary sells a premeasured kit of the requisite chemicals, which is helpful if you want to try the process without buying large quantities of chemicals or if you are making only a few prints. Their recipe can yield a print with rich blues, but they also include dichromate crystals to increase the contrast, which is helpful if you are using a thin and flat negative. Bostick & Sullivan sells costlier premixed cyanotype A and B solutions that take a little longer to expose but can make prints with more tonal range, and they also sell the new cyanotype kit, invented by Mike Ware in England. Author, chemist, and practitioner Ware claims that his process yields richer blues with more detail. All these companies are listed in the back of this book under Supply Sources.

Although different papers do not absorb the chemistry in the same amount and different coating methods require different amounts of chemistry, generally you will need approximately 1 oz (29.5 ml) of A and 1 oz of B for six 8 × 10 in. (20 × 25 cm) prints. The peak sensitivity of mixed A and B is 2 hours, but coated paper can be stored and used with reduced light sensitivity for a month.

3. Distilled water. Sometimes tap water suffices for making the cyanotype solution, but using distilled water prevents the frustration of mixing up possibly bad solutions. Or, use a chlorine filter with tap water. A dish tub filled with hot water can be used to warm the distilled water (see item 11).

4. Receiver. For rich blues, use nonbuffered or even slightly acidic paper. My favorites are "bright" (this is a relative term) white rag papers such as Arches Platine or Acquarelle, Saunder's Waterford, and Strathmore 500 single-ply smooth surface. Other choices might be Bienfang Rag Layout, Rives BFK, kitikata, and rice paper (which you can buy in rolls or sheets and is intended for sumi and calligraphy) on the textured side. Reasonably priced Magnani Prescia comes in pale blue and white paper stocks, and it is glorious to work on. I always write on the back of the substrate in pencil (or a laundry marker on the border for fabric) the information I find useful: name of surface, source of light, exposure time. Writing on the back also helps me remember which is the side to coat, because once I divide a large sheet, I can no longer find the water mark (see page 78 on every smaller piece I have made. Paper-maker Michelle Samour has prepared terrific sheets with my students by using Hercon 40 internal sizing and pulp with a high cotton content. One of my former Museum School students, Manon Whittlesey, has been blueprinting over black-and-white fiber photographs, keeping in mind that where the cyanotype emulsion is coated, it partially bleaches out the black-and-white image. You also can print on the back of fiber photographs. Other interesting surfaces include gampi paper and book pages, and cracked waxed paper. Each paper will yield a different range and hue of blues and will require slightly different exposure times.

Patrick Hilferty printed on doorskin plywood by first preparing the surface with diluted Goldens Fine Pumice Gel. He also was successful with a precoat of acrylic medium mixed with volcanic ash (from ceramic suppliers and not greenware) and Golden's Absorbant Ground. Hilferty suggests using sanding sealer if you want to apply cyanotype more directly on wood. Wendy Mukluk (www.astro.Wisc.edu/~mukluk) states that other unusual surfaces include birch bark, plaster precoated with matte spray paint, and metal and plastic prepared with a thin, fine layer of matte spray paint.

Cyanotypes take to natural textiles. More tightly woven fabrics, such as silk charmeuse, print a deeper blue than crepe de chine, which prints darker than pongee. Cotton print cloth provides darker blues than sheeting, which prints a deeper blue than knits or gauze. Cyanotype can be printed on duck canvas, cotton flannel, chamois leather, cotton velveteen, and viscose/rayon. In the *World Journal of Post-Factory Photography*, issue 5, August, 2000. Judy Seigel writes that she printed "on paper towels, paper bags, brown wrapping paper, coffee filters, old maps, sneakers, all-cotton jockey shorts, and T-shirts!"

Another student successfully used blueprint on bisque ware, but it is not safe for eating. And yet another student successfully coated cyanotype on hydrocal, which is a mixture of concrete and plaster. It is easier to learn the technique on paper before you try fabric and unusual surfaces.

5. Ultraviolet light. Sunlight, rather than artificial light, yields the richest blues. However, outdoor exposures can be nearly an hour during the New England winter, whereas they may be five minutes in the summer. A dependable artificial exposure unit is described on pages 67 to 75; it averages 18–20 minutes to expose a "normal" (not too dense or black and not too thin or clear) negative. Using a dense negative will take longer and, conversely, using a thin negative requires less time.

6. Sizing (optional). Rag papers usually are made with sizing, but if you use less-expensive paper, some rice papers, hemp, or absorbent papers, you can try ¼ tsp (1½ cc) of liquid gum arabic from an art store carefully blended into 2 oz (50 cc) of the mixed A and B sensitizer. I use spray starch as described on page 79. If you apply sizing unevenly, your prints may appear blotchy. Apply cyanotype sensitizer to the side of paper on which you will work.

Barbara Hewitt, formerly of Blueprints/Printables, recommends washing out the manufacturer's sizing in hot water before printing on fabric. It is meant to repel spilled liquids but makes the fibers almost impossible to coat.

7. Applicators. Soft house painting brushes or polyfoam brushes 1 in. (2.5 cm) or wider work well for coating the solution. Personally, I use the hake brush mentioned on page 81 because it is made without any metal that could be corroded, it holds up for years when properly maintained, coats as if it were gliding, and feels wonderful. So that the brush will not pick up too much liquid, I cut approximately ¼ in. (6 mm) evenly off the height of the bristles. Sometimes bristles will come loose, but you can usually pick them off after the emulsion is dry and before you expose it. Wash brushes between each coating procedure because contaminated brushes can produce imperfections in the print. Make sure that the brush, and especially a foam brush that tends to hold a lot of water, is almost completely dry before you use it again, or the wash water will dilute the chemistry. Avoid dipping metal brush parts in cyanotype solution.

The glass coating rod mentioned on page 81 saves on chemistry and can yield an almost machinelike even coating, or you can float one side of the paper in a tray of cyanotype emulsion or spray it on with an atomizer.

8. Printing frame. To achieve good contact between negative or flat object and cyanotype emulsion, use plate glass with Masonite, another piece of glass or foam rubber on a stiff backing; follow the instructions for building a frame on page 64; or buy one with a hinged back. You will be ensuring against blurry imagery. Make sure the glass is larger than the image (*not* the kind that

blocks ultraviolet light), clean, and dry before each use. Foreign particles lodged in the glass can create dimples in the print. If you are using vegetation, such as flowers or leaves, place a sheet of plastic wrap from a grocery store or clear acetate from an art store on top of the cyanotype emulsion. The heat from the exposure causes the vegetation to "sweat," which can cause stains. Dry and press vegetation for better contact and, therefore, better resolution. If you do not use glass, carefully pin in place plants that can blow about or are far from the surface.

9. Two dark storage bottles. Recycled brown glass bottles that the chemicals came in or brown glass pint (½L) fruit juice or large vitamins jars are ideal, but they are hard to find. Glass washes out more thoroughly, but plastic bottles might be your only choice. Do not use metal caps, which will corrode from exposure to the chemicals. The bottles should be washed before fresh chemistry is poured in, and one should be labeled Cyanotype A, the other Cyanotype B, and both should include the date each solution was prepared. Keep liquid chemicals in tightly closed brown bottles inside sealed plastic bags in a cool, dry area. They will keep for six to nine months. If the emulsion is not yellow-green when you mix A and B, consider disposing of the liquids and mixing new solutions. If you use such old solution, you will probably get a print that is pale blue, rather than the white of the paper, in the highlights. Eventually, the emulsion will not even yield any separation of tones.

10. Laundry bleach or 3% hydrogen peroxide (optional). Dilute and use it to intensify the blue of the image, as described in the step-by-step instructions. Hydrogen peroxide solution will de-gas slowly and lose its potency; do not store it in a tightly capped bottle. Of the two, laundry bleach is more harmful to the environment. In addition, a dilute acid, such as white vinegar from the grocer, can be added, drop by drop to the mixed sensitizer if you need to increase the highlight range of the print. Do not allow the acid to come in contract with undiluted potassium ferricyanide (see Safety above).

11. Two trays or tubs. They must be nonmetallic and larger than the print, as one holds the intensifying solution and the other holds the wash water. A tub can also double as a container of hot water for heating up distilled water while making the stock solutions.

12. Siphon washer. This gadget, available on eBay, works well when attached to a tray in a sink to wash prints. Or you can drill small holes up the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains off. Blot the print afterward with a clean, soft sponge.

13. Sheet of glass or Plexiglas™ (optional). Angle the glass in a sink, sprinkle the Plexiglas™ with a little water to form a suction with the paper, then lay the exposed print on to it while you develop the image with running water from a hose. This system allows unexposed chemicals to drain off, preventing them from contaminating the print. Wrap masking or duct tape around the edges to prevent the glass from cutting you and to cushion the glass from breaking.

14. Measuring cups or beakers and spoons. Inexpensive cookware, such as a glass measuring cup and a plastic tablespoon, will do. You will need a plastic teaspoon for stirring chemicals and water.

15. Funnel. Use a glass or plastic funnel to pour dry chemicals when mixing the stock solutions. If mold forms in one of the stock solutions, you can strain it by pouring the liquid through a funnel fitted with a coffee filter, and it still will be good unless it has turned blue.

16. Newspaper or oilcloth, paper towels or sponge. Cover your work area with layers of newspaper that can easily be removed when contaminated or with oil cloth (available from a hardware store, Buckaroo's Mercantile, or the Vermont Country Store, listed in Supply Sources) that you frequently wipe clean. Old chemicals can ruin future prints with stains.

17. Neoprene gloves should be worn while you work. A respirator should be put on when you mix raw chemicals and if you are using a hair dryer to dry the emulsion.

18. Hair dryer or clothesline and pins. The emulsion has to be completely dried because if photographic negatives or black-and-white photos come in contact with wet cyanotype solution, the blacks will bleach out. If inkjet negatives touch liquid, the ink runs. Wear a respirator and use a hair dryer on the cool setting or a fan to thoroughly dry the coating before laying a negative on top. Do not use electrical appliances near water. I use nylon screening from the hardware store extended over and stapled to canvas stretchers from an art store as a drying rack in a dark area. A clothesline and pins can be used to create a drip coating with wet emulsion, or to dry finished prints.

19. Gray Scale and tape (optional). During the exposure, you can employ a transparent Stouffer step tablet or make one digitally (see Chapter 6) next to the image area, and use Step 1 to be DMax (the deepest blue with little or not detail). If you are not using a hinged printing frame, use clear removable tape to form a hinge between the edge of one side of the negative and the substrate. The tape ensures that the negative does not move after you have placed it on the coated and dried paper. Do not press the tape down too hard, or it will lift up the emulsion when you try to remove it later. Cheap tape is better because it does not hold as strongly!





Randi Reiss, *Domestic Constructions,* **5 × 4 × 4 ft., Blueprinted House cyanotype oil stick and enamel on paper, and 4 × 2 × 2 ft. Blueprinted Chair cyanotype on wood, 1986.**

Reiss, whose background is in painting and printmaking, set up this installation where she combined the cyanotypes with different mark-making tools, such as oil stick crayons. The transparency for the cyanotype was made from India ink brushed onto acetate and manipulated with water and a scratching tool. The fluidity of the ink on acetate was conducive to exploiting cyanotype's fluid qualities so that the prints serve as a continuous drawing.

Making the Stock Solution



Stock Solution A

Stock solutions are the main concentrate of liquid chemistry from which working mixtures are made. This recipe is for using the emulsion under artificial light.

Equipment You Will Need

Ferric ammonium citrate
Brown bottle
Distilled water
Label
Funnel
Stirring spoon
Thermometer
Measuring cup
Tub



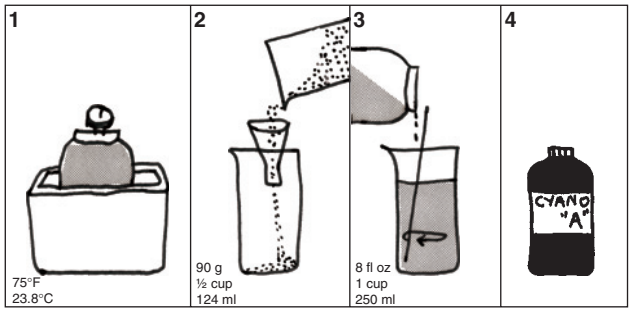
Procedure

1. Adjust water temperature to 75°F (23.8°C).

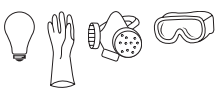
2. Using a funnel, pour 90 g (124 ml) ferric ammonium citrate into glass beaker.

3. With constant stirring, add enough water to make 8 fl oz (250 ml).

4. Stir solution until mixed and pour into a labeled brown bottle. Wash utensils in hot water.



Making the Stock Solution



Stock Solution B

Equipment You Will Need

Potassium ferricyanide
Brown bottle
Distilled water
Label
Funnel
Stirring spoon
Thermometer
Measuring cup
Tub



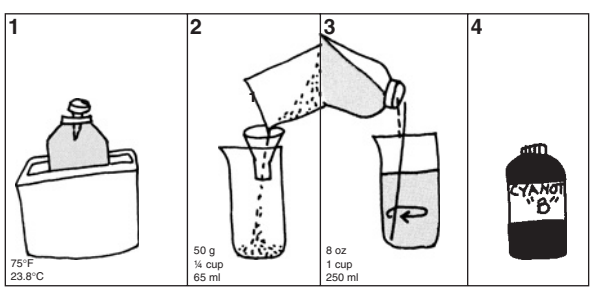
Procedure

1. Keep water temperature at 75°F (23.8°C).

2. Using a funnel, pour 50 g (65 ml) potassium ferricyanide into a beaker.

3. With constant stirring, add enough water to make 8 oz (250 ml).

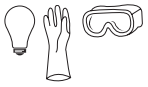
4. Stir solution until mixed and pour into a labeled brown bottle. Thoroughly wash all utensils in hot water.



Making a Cyanotype



1



Preparing the materials

Shake each bottle of solution, then mix 1 oz (29½ml) of A and 1 oz of B together to coat six 8 × 10 in. (20.25 × 25.5 cm) sheets of paper. Use within 2 hours for maximum sensitivity.





2



Coating the paper

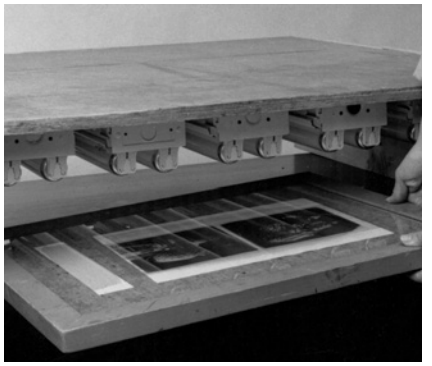
Dip a brush in the mixture and apply a small amount to the paper, lightly moving the same solution around so as to avoid saturating one area. Coat beyond the image area or coat an extra swatch of test paper so you can watch the change in color during the exposure. It should now appear yellow-green. The solution will shine. Use the cool setting of a hair dryer on both front and back of the substrate, air dry flat, or hang the paper in a dark room to create drip patterns as the emulsion dries. It should be a matte bright yellow.

5



Intensifying the print (optional)

Rock the print for a few seconds in a tray of two capfuls of bleach 3% hydrogen peroxide to 32 oz (1 L) water, until the image turns a deeper blue. This darkening would also appear as the print dries and ages.



3

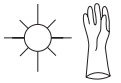


Exposing the print

Place the paper, coated side up, on a backing board or in a hinged printing frame, then position the negative, correct-reading, on the emulsion. Lay this unit under glass.

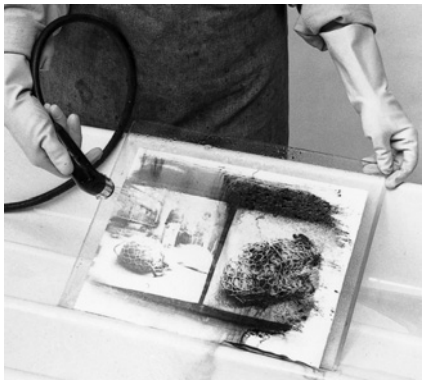
Place the loaded print frame in direct sunlight or under artificial ultraviolet light for 5–20 minutes. As the emulsion is exposed, the cyanotype will turn from yellow-green to blue-green to iridescent blue. Alternatively, take the unit into a shady spot or turn off the exposure unit, and carefully lift up the hinged negative. Check to see if the highlights of the print have more tone than you want. If they are not, return the unit to its original position and expose more.

6



Washing the print

Use the siphon or tub method to wash the print for ten minutes. Then blot excess water with a clean, soft sponge and air dry on a rack, hang from a clothesline, or use a hair dryer or fan.



4



Developing the print

Remove the paper and prop it on a piece of Plexiglas™ angled in a sink. Hose the paper with water, or rock it in a tray of water, which you must change frequently. No yellow should remain on the paper, and the water eventually should run clear.

Tips

■ To shorten the exposure time later, add a little extra ferric ammonium citrate to stock solution A. To increase the longevity of the stock solutions and to increase their solubility (good for less porous surfaces), add a pinch (approximately 1.25 g) of oxalic acid, a crystal purchased through chemical suppliers listed in Supply Sources.

■ If you will be exposing the emulsion in bright sunlight, cut the stock solution recipe to ¼ cup plus 1 tsp (50 g or 65 ml) ferric ammonium citrate and enough water to make 1 cup of solution A and ⅛ cup (35 g or 59 ml) potassium ferricyanide, and enough water to make 1 cup of solution B. Not only is this formula less expensive, but it also is kinder to the environment.

■ I learned the hard way that potassium ferricyanide, even in the dry form, goes bad, albeit slowly. After mixing a fresh batch of cyanotype solutions for a class demonstration once, the exposures under my trusty ultraviolet unit were taking an hour and longer to obtain the normal, deep blues usually achieved in 20 minutes. So I did some troubleshooting, eliminating variables one by one. I dismissed the possibility that the emulsion was mixed incorrectly because all my students had watched me carefully measure. I knew I did not use a particularly dense negative for the demonstration. I tried replacing the ultraviolet bulbs and using a new bottle of distilled water. Next I rewashed all the mixing utensils to eliminate contaminants and opened a fresh jar of ferric ammonium citrate (which I knew could deteriorate with age or prolonged exposure to light) and mixed fresh solution A. Only when I opened a new bottle of potassium ferricyanide and mixed fresh B solution did the exposures return to normal. Ferric ammonium citrate (solution A) is more readily affected by age and light, so make sure the brown bottle is tightly sealed.

■ To enrich the deep blues of the cyanotype print, layer the emulsion twice. That is, let the first (thin) coating almost completely dry, then apply the emulsion a second time. Adjust the exposure, which will be only a little longer than if you were using a single coating. This method is rarely needed on good rag papers.

■ Rinse and carefully dry the brush as soon as you finish coating the paper. Shield remaining mixed emulsion with an opaque cover, such as the black plastic in which photo paper and ortho film (see Chapter 5) are wrapped.

■ Stir the solution if it has been sitting (even during the brief time you have been working). I teach in a chilly room, so I keep the emulsion warm, not hot, to maintain the chemicals in solution, rather than precipitating out. Warm solution also makes the emulsion speedier when exposed.

■ Mixed cyanotype solutions A and B last only one day. BluePrintables keeps mixed A and B solution for months in a porcelain tub covered with black plastic. Precoated paper will keep for a few days if stored in a light-tight box, and for 6 months in a light- and air-tight bag. You can tell if the emulsion has started to go bad by observing the coating before exposure; it should be yellow-green.

Tips (*cont.*)



Laurie Snyder. *Iron and Silver*, 1990. Cyanotype and Van Dyke (Chapter 8) on Rives BFK from camera negatives and cliché verre (drawings made as the negative on a transparent or translucent material) negatives. Artists' book: 22 × 15 in. closed, 22 × 30 in. open.

Even so, BluePrintables suggests that "soaking an oxidized dark print with little contrast in very hot water following the rinse-out will brighten it significantly."

- Be sure the emulsion is completely dry before exposure, or negatives can be damaged and the finished print will show purple stains.

- If you do not use glass, you can lay or pin plants or objects on wet emulsion to expose. The articles will pick up blue color, so use ones that are disposable. In 70°F (21°C) to 85°F (29°C) weather, the emulsion also dries during the 5- to 10-minute exposure.

- Uneven application of the solution will cause streaks in the print. However, you might purposely coat cyanotype onto "distressed" wax paper so that it bleeds into the cracks.

- If you hang coated paper or fabric to dry on a clothesline, wash clothespins and line before the next use, or you may stain future pieces with contaminated solution. Use plastic cord and pins because they are easily washed.

- If you use a standard print frame, unhinge a portion of the back and, without moving the negative, check highlights of the print for color changes. Exposure is judged visually. With a thin (more transparent) negative, remove the paper at the blue-green stage, and with a dense (black) negative, the paper should be iridescent blue.

- Exposures can be roughly calculated as you would a traditional black-and-white photograph. If you want the print to look twice as dark, expose it for twice the time, and the converse is true, too. However, when in doubt, overexpose, because you can save the print as explained in the next tip.

- If the print is too blue, it probably was exposed too long, but you might rescue it by leaving it in the intensification bath or by toning it, as explained later in this chapter, to reduce the overall color. If the print is too pale, it probably was underexposed, so next time increase exposure time, decrease intensification time, or further dilute the intensification bath.

- Chemical baths applied to the developed cyanotype can turn the image green, violet, black, purple, or red-brown. They are described later in this chapter, but they do tend to challenge the permanency of the cyanotype print.

- If you are combining cyanotype with brown, casein, or gum printing, do the cyanotype first or it will alter or obscure the image underneath because potassium ferricyanide is a photographic bleach. If you, being of the experimental nature, still choose to blueprint second, however, eliminate the bleach intensifier. Fixer from the brown print (Chapter 8), additionally, can slightly bleach a blueprint.

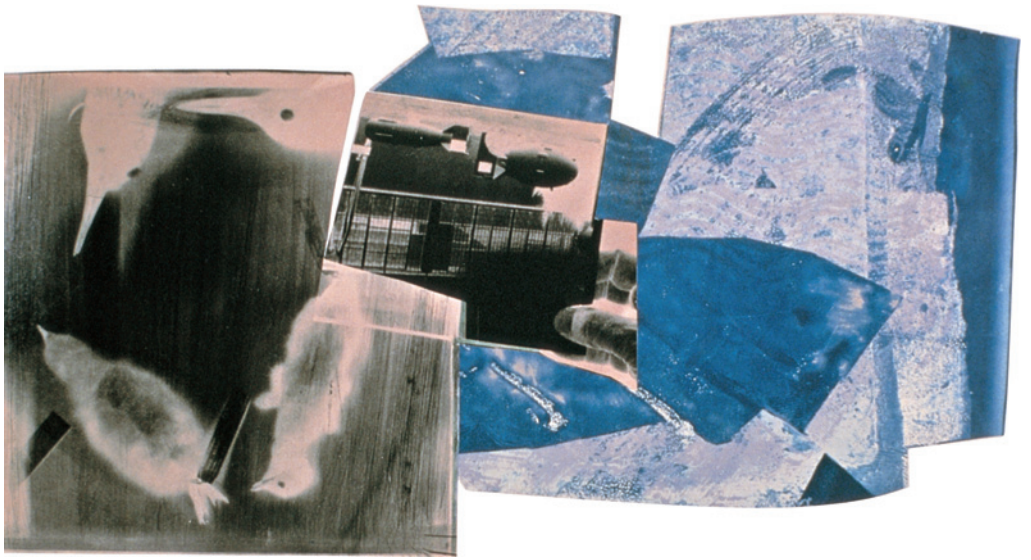
- Cyanotype works beautifully over dry palladium prints. Make the palladium print normally. Cyanotype does not affect palladium underneath—it is great for mixing a photogram with a photographic

Tips (*cont.*)

image, separated by the processes' or for "split toning" the print. You even can develop the cyanotype in water and intensify with hydrogen peroxide without affecting the palladium print underneath. This combination works well on many papers, including Japanese paper. Use separate brushes and wash each immediately. Or, use a gloved finger, cotton swab, or sponge to spread the emulsion. In addition, you can coat wet cyanotype and soon after coat wet palladium, dry, expose, develop, and clear the combination as a palladium print. This wet and wet intentional "contamination" produces greens and yellows.

■ Apply a solution of ¼ oz (5 g) oxalic acid with 3¼ oz (100 ml) water as an after treatment to clear white areas of residual blue. See the Safety section or page 212 for handling oxalic acid.

■ If you do not wash the print enough, the white areas may turn blue while drying or form a blue puddle because some of the yellow emulsion is left on the paper. However, I have recently noticed that the tap water I was used to using for a 15-minute final wash, now bleaches the whole print. I suspect that chloramine is being used in larger quantities by the city as a disinfectant, so the water has turned more alkaline. I have cut the final wash back to 5 minutes, which still rids the print of any residual hydrogen peroxide or unwashed emulsion. John Barnier, in *Coming into Focus: A Step-by-Step Guide to Alternative Photographic Printing Processes* (see Annotated Bibliography), states that adding ¼ oz (10 ml) vinegar or 28% acetic acid (i.e., "stop bath") to 2.1 qts (2 L) of water prevents bleaching from alkaline water.



John Wood, ***Loon Drawer with Bomb*****, 20 × 24 in., collage of cyanotype and stained photographs, 1987.**

Tips *(cont.)*

- To remove lavender stains, try rewashing the print well and letting it dry. Often the lavender fades. If not, squirt 1/2 tsp (2.5 ml) of liquid hand soap, such as Ivory, Palmolive, or Dove in a clean try. Add 1 gal (3.8 L) water. Swish the print for a few minutes. Wash in plain water afterward.
- If you notice water spots on the finished print, you probably dripped a liquid on the emulsion before you exposed it. If you find brown streaks, the cause could be drying the print in the sun or impurities in the water.
- Store the coated paper or the finished print face up on a clean surface. I use frequently washed nylon screening racks. Old chemistry accidentally picked up on your paper or fabric can stain through to the front. Contaminated blueprint chemistry stains purple. Do not keep the print in an alkaline or buffered paper box.
- You can touch up the blue print with a watercolor pigment such as Prussian Blue.
- If a print starts to fade due to the action of ultraviolet light on alkaline paper, you can revivify it by storing it away from light for a short time.

Cyanotype on Fabric

Laura Blacklow, Eliza Proctor, Cambridge Public School Students. Cyanotype on cotton, sewn onto hoola hoops, ribbon. Created for the Cambridge River Festival. Photo: L. Blacklow.
Funded by a grant from the Cambridge, MA, Arts Council, we asked students to draw underwater scenes on a roll of acetate (which also protected their skin during the exposure).We had precoated the fabric, wrapped it in layers of opaque trash bags and brought it to the playground, where we set up a "tent" of heavy mulching plastic and bamboo poles. When the fabric was rolled out, the acetate laid on top, and the students pretended to be swimming, we quickly rolled back the tent, exposed the whole scene for 7 minutes, then put everything away while we washed up the fabric.





Tips

In addition to the previous tips given in this chapter, the following tips are useful when printing cyanotypes on fabric.

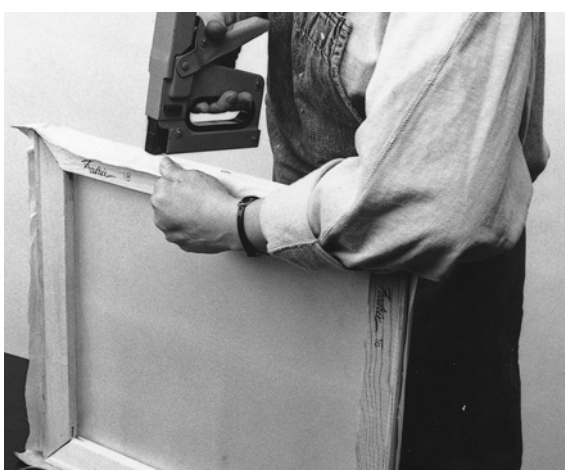
- Certain natural textiles accept cyanotype solution better. More tightly woven fabrics, such as silk charmeuse, print a deeper blue than crepe de chine, which prints darker than pongee. Cotton print cloth provides darker blues than sheeting, which prints a deeper blue than knits or gauze. Cyanotype can be printed on flannel, duck canvas, chamois leather, cotton velveteen, and viscose/rayon.

- You can simply create visual variables if you use colored, rather than white, fabric. It is easier to learn the technique on paper before you try fabric.

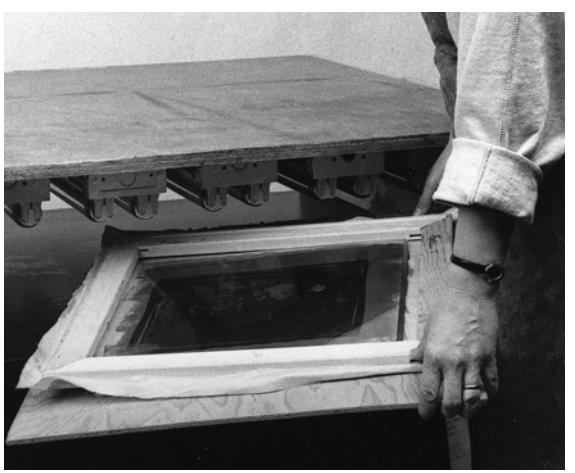
- Fabric should be stretched to pull out wrinkles during coating. As described on page 66, I use canvas stretchers or plastic embroidery hoops to pull the material tightly before coating. I leave the fabric on the frame through the coating, exposing, washing, and drying. Like paper, fabric can be coated lightly with a brush (foam brushes are superb), sprayed, or dipped into a tray of solution, but thorough drying will take longer because the fabric might seem dry when it isn't. See the three illustrations below.

- Use a laundry or permanent marker outside the image area to remind yourself of the type of fabric, exposure, etc. If the fabric is thick enough, mark on the back, so that you will know the correct side to coat. If it isn't thick, use masking tape on the back, so you will know which side you coated.

- Fabric artist Eliza Proctor advises not to air dry the freshly coated emulsion on humid days and nights, or you may get a mottled print.







Stretching, coating, and exposing the fabric.

Tips (*cont.*)

■ For more detail in the finished piece, use a warm, not hot, iron on the back of the coated and dried fabric before exposure, and use plate glass during the exposure, because this way your negative will be in closer contact with the sensitized surface. Dry extra carefully, because the fabric might seem dry when it actually is not.

■ Sandra Sider, in an article entitled "Blues in the Light: Cyanotype on Fabric," in *Fiber Arts* (Sept./Oct. 1986), suggests that cyanotypes impart an iron stain to the fabric that is permanent. "Even though cyanotypes might fade somewhat in ultraviolet light, the intensity of the blue can be revivified by storing the piece away from light for a short period of time" (a couple of hours to a couple of weeks). Richard Farber explains in *Historic Photographic Processes* (see Annotated Bibliography) that a partial reduction of the Prussian blue to the white ferrous ferrocyanide occurs; this regenerative ability is unique in photography to the cyanotype.

■ Blueprinted fabric pieces can be washed in cool water with a mild liquid soap or dry cleaned. Avoid detergents and soaps with chlorine bleach or borax. Baking soda and soda in washing



Joan Lyons, (left) ***Tumbling Worlds*** **quilt, 70 × 72 in., cyanotype on colored cotton 1990, and (right)** ***Untitled*** **quilt, 60 × 70 in., cyanotype on colored rayon, 1992.**

Tips (*cont.*)

products or underarm deodorants will cause the blue to turn yellow. Powdered soap does not dissolve properly, creating spots on the fabric wherever granules touch the wet blueprint. Residue in and on washing machines where powdered soap is used also will affect the blueprint.

- Sometimes you can remove purple stains in fabric by washing it in ½ teaspoon (2.5 ml) liquid soap, such as Ivory or Woolite, and 1 gal (3.8 L) water. Rinse well afterward. Washing blueprinted fabric will restore the blue color, but it is usually less intense. Powdered and biodegradable soaps are not recommended. Use Spray'n'Wash, K2R (available at hardware stores and the Vermont Country Store listed in Supply Sources), or Rit Grease, Stain, and Soil Remover #90.
- Never—in the coating, drying, or washing—wring the fabric, or you can create permanent marks.
- Blue Sunprints supplies precoated T-shirts, cotton, organza, and silk by the yard, and 8½ in. square quilt pieces. You can also send them your fabric to coat.

Toning Cyanotypes

Cyanotypes can be toned to other colors, but John Barnier, in *Coming into Focus* (see Annotated Bibliography) states that most toners, except the one with highly toxic lead acetate, which I do not recommend or write about, or the one with sodium borate, are not stable.

Make a few dark (overexposed) prints and let them dry for a day. Later, presoak them in water and sponge excess water off. Either pour the toning mixture into trays and bathe the print until you get the color you want, or apply the solution with a brush to selected areas. Keeping an untoned print nearby will help you decide how long to tone. Once the mixture becomes exhausted and no longer affects the print, discard it and mix fresh toner. Wash the print carefully after toning. Most of the necessary chemicals are available through Photographer's Formulary.

For a gray to reddish tone, dissolve 1/16 oz (4.8 g) copper nitrate in 3.3 oz (96 ml) distilled water, then add 5–7 drops household ammonia.

For brown to black tones, add ⅓ oz (10 ml) ammonia hydroxide to 3.3 oz (96 ml) distilled water in one tray. (Alternately, you can use the yellow-tone recipe below to bleach the color out.) In another tray, combine a little more than ⅓ oz (10 g) tannic acid, available at a pharmacy or wine-making store, with 17 oz (500 ml) warm distilled water. You can also obtain tannic acid by seeping 10 pekoe tea bags in 2 cups (0.5 L) water. Immerse the cyanotype in the first solution until it practically disappears, wash it carefully for a few minutes, then put it in the second bath until you achieve the desired color. If the paper base and highlights look stained, you might not have washed the print long enough between the two baths.

Judy Seigel (retired editor of the *World Journal of Post-Factory Photography*) recommends this alternate formula for brown or black tones: add 1 teaspoon or more tannic acid to 1 qt (0.95 L) distilled

water in a tray. In another tray, add 2 teaspoons sodium carbonate to 1 qt (9500 cc) water. Immerse the cyanotype in the first bath for 2 minutes, then rinse it and put it in the second bath. Rinse it again and put the print back in the first bath. Continue in this manner until you achieve the desired tone.

For yellow tone, Barbara Hewitt (formerly of Blueprints/Printable) recommends dissolving 1 tablespoon trisodium phosphate from a hardware store in 1 qt (0.95 L) warm water. I have also used a weak solution of chlorine bleach from a grocery store to achieve the same effect.

Search for more recipes online at http://www.duke.usask.ca. Or, consult the directions in *The Keepers of Light and Photo-Imaging: A Complete Guide to Alternative Processes* (see Annotated Bibliography).

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Panorama of William H. F. Talbot's Reading Establishment, the first mass photo-printing company, advertising the capabilities of his studio: copying paintings, photographic portraiture, printing negatives into positives, and photographing sculpture. Talbot is in the middle removing the lens cap from a large-format camera because there were no shutters on cameras. The process he probably is using, which he invented in 1841, is *calotype*, also known as *Talbotype*. "Fine-quality writing paper was sensitised with potassium iodide and silver nitrate solutions and exposed in the camera, typically from ten to sixty seconds in sunlight. The negative was then developed in a solution of gallic acid and silver nitrate, and fixed. The paper was generally waxed after processing to make it translucent, and was printed in sunlight onto salted paper."[1]

[1] Coe, Brian, and Mark Haworth-Booth. *A Guide to Early Photographic Processes*. London: Victoria and Albert Museum, 1983, p. 17.



Notice the chair and armrest for the sitter, provided so he would not move during the long exposure, and, behind Talbot, the printing frames, so similar to what we now use. The man on the far right might be in charge of a focusing device.

I have thought it almost comical, in a way, that photography should have begun in England, where the weather is not known to be especially sunny year-round (recall the famous London fog). And so, I would imagine that the glass structure, like a greenhouse, behind the sitter, was used to accommodate those rainy and cold days while letting in the most light possible. I am also fascinated by the fact that Talbot's home, Lacock Abby, which he often photographed, is not too far from Stonehenge. Yet Talbot, who was a sophisticated amateur archeologist, seems not to have ventured there with his camera, although he did take pictures in France and Spain.

Chapter 8

Van Dyke Brown Prints

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- Making the Solution 177
- Making a Brown Print 178

A brown print and its younger sister, *kallitype*, can be made on paper, leather, or fabric and can yield permanent images rich in detail, with subtle separations in the middle tones and shadows, ranging from pale to deep Van Dyke brown. A photographic negative, when placed in contact with the silver-based emulsion, produces a positive picture after relatively short exposure to daylight or ultraviolet light. The longer the exposure, the darker the brown of the print. A brown print also reacts positively to such toners as polytoner, selenium, sepia, copper, and blue (see Chapter 3, Toning) to produce purples, pinks, and blues. Brown printing, which is costlier than cyanotype, due to the price of silver nitrate, one of its component chemicals, can be combined with some other techniques described in this book and with traditional artists' materials such as paint and pastels.

William Henry Fox Talbot, basing his experiments on the work of earlier pioneers in photography (see Chapter 14, Contemporary daguerreotypes), is considered the originator of photographic printmaking.[2] In 1834, Talbot had made semipermanent negative photographs on paper soaked in silver chloride and fixed in salt, then he made positives by contact printing the images onto another sheet of paper treated in the same way. He kept this discovery secret until he heard about Daguerre, across the English Channel, announcing his direct positive process. Talbot's 1839 public proclamation of the discovery of "the process by which natural objects may be made to delineate themselves without the aid of the artist's pencil" (Talbot's words), i.e., "salt printing" and, later, patented as the "talbotype," is closely related to Van Dyke brown printing. Talbot devoted himself to photography and struggled with the art for years. He worked hard to perfect his process so that, by 1840, he patented—which kept it from being widely used—the calotype process, in hopes that it would rival the daguerreotype for short exposures and details with portraiture. Talbot made the images permanent by fixing them in a bath of sodium thiosulfate (still a component in today's fixer), suggested by Sir John Herschel, inventor of the cyanotype process (see Chapter 7). Many historians consider Talbot the originator of modern photography because he formulated a technique that allowed the practitioner to make one negative and print it as repeatable, rather than one-of-a-kind, positives on paper, and he eventually discovered how to strengthen these prints chemically from indistinct images to clear and subtle renderings. Very soon after, photographers used his process to travel the colonized world, taking pictures of remote places and people. I try to imagine having seen only painted and drawn renditions of faraway places, then witnessing my first photograph of the

[2] Crawford, William. *The Keepers of Light. A History and Working Guide to Early Photographic Processes*. Dobbs Ferry, NY: Morgan & Morgan, Inc., 1979, p. 16.

Pyramids! It must have been an extraordinary experience, perhaps akin to watching television for the first time when I was a child.

In addition, Fox Talbot patented a photo-engraving method, and is also credited with the idea of breaking up a black-and-white image into small dots for reproduction on a lithography plate, which is the basis for halftone offset printing. His Reading Establishment, pictured at the start of this chapter, was the first commercial photo studio in the world. Romain Talbot is credited, a few years later, with first producing a practical method for copying architectural and engineering drawings onto paper sensitized with silver salts.

In 2006, Talbot's family gave his photos, notebooks, manuscripts, correspondence with other key scientists to the British Library. In addition, his home, Lacock Abbey, is open to the public.

Safety

Silver nitrate in crystal or solution form is destructive to the skin, mucous membranes, and eyes, so wear neoprene gloves, safety goggles, and handle the chemical with care. In case of skin or eye contact, flush the area with water, followed by soap and water. If it gets in the eyes or mouth, seek medical attention immediately.

Do not inhale silver nitrate dust. Wear a mask with a dust filter both when mixing and when hair-drying Van Dyke brown emulsion. Tartaric acid is moderately hazardous if inhaled or touched.

If you do get brown stains on your skin, wash the areas, then let them wear off.

Silver nitrate can supply oxygen to a fire. Clean up spilled silver nitrate with water and dispose of excess down the drain, not in a wastepaper basket, or cover the spill with dry sand or dry ground vermiculite, which you enclose tightly in a container for proper disposal.

If ferric ammonium citrate comes in contact with heat higher than 300°F (147°C) or concentrated acids, such as stop bath, a poisonous hydrogen cyanide gas will be released. Therefore, long exposures to ultraviolet light should not be done with sunlamps. Ferric ammonium citrate is slightly toxic, so wear protective gloves at all times and a protective mask when handling the powder form. Never mix ammonia products with bleach, since the combination produces lethal fumes.

Most fire departments want to know the location and types of chemicals stored in your home.

Never ingest chemicals.

Clearly label bottles and keep them out of the reach of children and pets. Brown print solution can be fatal if swallowed and can severely damage the eyes if splashed.

Dispose of excess chemicals by washing them down a drain with large volumes of water.

Old fixer or hypo solution produces highly toxic sulfur dioxide gas, so discard fixer that no longer is clear in color.

Method Overview

1. Brown print solution, containing silver nitrate and ferric salts, is mixed, coated onto paper or fabric, and dried in subdued light.

2. An enlarged negative or object is placed on top of the coated surface. Ultraviolet light shines through clearer parts of the negative or around the object and hits the coating, reducing some of the ferric salts to the ferrous state.

3. The negative is removed, and the exposed paper or fabric is washed in water, where the ferrous salts reduce the silver nitrate to metallic silver, visible as a brown image. The print is fixed in a chemical bath, and washed again to produce a Van Dyke brown print.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio and Chapter 7, Cyanotypes.

1. Image. To make a positive print rich in detail, either use a negative transparency the same size as the positive you wish to create or use real objects. Even semitransparent objects, such as leaves, show the veins. Brown printing will pick up and render a wide range of tones, but I prefer negatives that would print with a #1 or 2 filter on polycontrast black-and-white paper. We have carefully worked out a wide tonal range digital profile (see Chapter 6) for brown printing on Platine paper.

I use a pencil to lightly draw around the edge of the image, and that outline provides a template for where I will coat. In addition, I use pencil on the back of the paper to write information such as paper type, sizing if there is any, date, exposure source, and time.

2. Chemicals. You will need 1 oz (30 g) silver nitrate crystal, ½ cup (90 g) ferric ammonium citrate (green anhydrous), and 1 tablespoon (15 g) tartaric acid; all are special-order items from one of the merchants listed in Supply Sources. Fixer (hypo) is available at photography stores, as is fixer remover, which decreases the final wash time. If you will be toning the print later, use a fixer without hardener, such as Ilford Rapid Fix without the B bottle, but stay away from rapid fixers that seem to bleach the print. I prefer Carmen Lizardo's recipe for fixer, which I found in an old issue of *Post Factory Photography*: to make a 5% solution of "hypo" mix 1¾ oz (50 g) hyposulfate to 0.95 qt (1000 ml) distilled water with 1 teaspoon household ammonia to lessen the possible bleaching affect. Using this recipe, rather than a premade liquid fixer, I notice fewer problems caused by fixer fading the print. In addition, hypo clear or fixer remover, which cuts back the wash time and helps with the longevity of the print, is available at photography stores. The much more toxic hypo eliminator is unnecessary. Store chemicals in tightly capped bottles in a dry place.

Bostick & Sullivan (see Supply Sources) makes premixed brown print solution, which I now use, after decades of mixing from scratch, because I would rather spend the extra money and not risk my health from possibly breathing in unhealthy particles. Photographer's Formulary (see Supply Sources) packages a more economical kit with all the components, and it is helpful in case you want to try this method without investing in quantities of chemicals or if you need to make only a few prints. Kentmere in Europe sells the closely related Argyrotype process kit, complete with sensitizer, direct positive film, 8 × 10 in. (20 × 25 cm) paper, measuring cup, applicator, glass rods for coating, and instructions. It is also made in England by Fotospeed.

Some printers use no more than one or two drops of 10% solution of potassium dichromate—that would be 2 teaspoons (10 g) dichromate to 9.5 oz (100 ml) distilled water—in the first wash of 1 pint (500 ml) distilled water for rendering more contrast. The dichromate solution also can help clear highlights if you have used emulsion that has started to go bad and appears a pale brown, rather than pale yellow, when coated. Dichromate or bichromate is a carcinogen; it must be carefully handled with gloves, goggles, and respirator. In addition, it is terribly toxic for the environment, so I try to stay away from dichromate, and its effect is limited. Liam Lawless, a great experimenter with formulae, recommends substituting 3–6 g ferric citrate for the same amount of ferric ammonium citrate (mix it into hot water, then allow it to cool before adding it to the van dyke solution) to see a noticeable difference in contrast.

If you use a hose and tap water, you may find that the excess emulsion is not washing out. Lizardo recommends a pinch of citric acid (or lemon juice) to the first bath so that you change the water from alkaline to slightly acid.

3. Distilled water. Sometimes you can get by with tap water for making the brown print solution, but the use of distilled water prevents the frustration of possibly mixing bad solution (see item 10). A dish tub filled with hot tap water can be used to warm up the distilled water.

4. Receiver. Use paper larger than the image for ease of coating it. Finished prints should be made on rag paper of medium absorbency, but practice prints can be made on less-expensive paper. Photographer's Formulary (see Supply Sources) suggests Crane's Kid Finish AS8111, which they and stationery stores sell and is made from cotton. Since different colors of paper affect the color of the finished brown print, I often use Rives heavyweight and BFK, whose white is really an off-white and whose tan is really tan, for a more continuous tone appearance. I have occasionally had a staining problem with BFK, so I lightly size the paper (see page 79) with the gelatin method or with spray starch. Bostick & Sullivan sells a smooth paper, Cranes Platinotype, which has a pale yellow-white appearance. The brightest white without artificial whiteners can be obtained on the gorgeous, perfectly sized, but expensive, Arches Platine; however, the print can appear more contrasty due to the deviation between the deep browns of the image and white of the paper. My students have also used book pages and handmade papers from India. I have printed Van Dyke on Tyvek™ (spun plastic that looks a bit like rice paper but is impressively durable) by coating lightly with a sponge brush, working the emulsion in evenly with a dry sponge brush, and over exposing it.

You may be inspired by Talbot's waxing of prints (see caption under "The Reading Establishment"). He used this technique to make thin paper transparent enough to employ as a negative, yet the transparentizing of paper might be an aesthetic you are interested in. One method for accomplishing this appearance is described near the end of Chapter 5.

Natural fabrics, such as a close weave cotton, accept the brown print solution best and yield the deepest tones, but brown printing can be done on synthetic fabrics, such as bridal or slipper satin, and painter's cotton duck canvas. Avoid permanent-press cloth, which repels the solution. It is easier to learn the technique on paper before you apply it to fabric. See Chapter 7, Cyanotypes, Materials and Tips, for more details (pages 153 and 163). I always mark on the back of the substrate in pencil

(or laundry pen with fabric) the information I find useful: name of surface, source of light, and exposure time. Writing on the back also helps me remember which is the side to coat, because once I divide a large sheet, I no longer can find the water mark (page 78) on every smaller piece I have made.

5. Sizing. Good rag papers tend not to need more sizing than the manufacturer has put in. With hemp, Rives BFK, and other absorbent surfaces, sizing is essential. Different sizings can affect the color of the final print, so experiment with methods described in Chapter 4. If you do treat the paper, definitely size it evenly and thinly first. Uneven and thick sizing can cause uneven stains on your print.

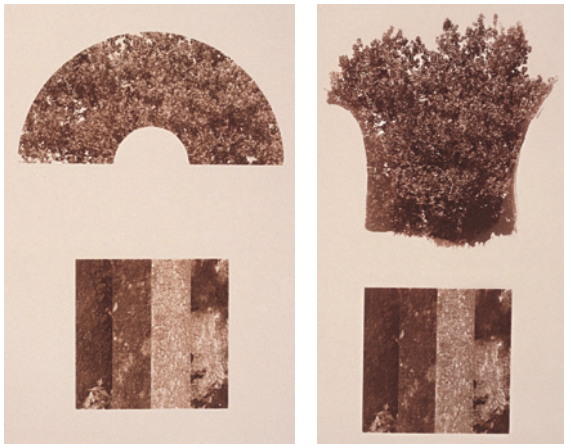
Using hot water, wash out the manufacturer's sizing before printing on fabric. Hot water will preshrink the fabric, which is useful if you are going to employ another technique on top of Van Dyke. In Chapter 4 and the end of Chapter 7, I describe my method for stretching fabric before coating, exposing, and processing.

6. Light. If you have built an ultraviolet light exposure unit as described in this book, you probably will need 10 minutes to expose a "normal" (not too dense or black and not too thin or clear) negative. Warm sunlight is also suitable and yields even deeper tones in less time. I find Van Dyke emulsion needs almost exactly half the exposure than a cyanotype requires. Using a dense negative will take longer and, conversely, using a thin negative requires less time, but too thin a negative eliminates much of the detail that brown printing can render. Thick fabric will take longer to expose.

Mix and coat the chemicals in subdued light or under a safelight. I illuminate the coating area with an ordinary 40-watt tungsten bulb because I need to see where I have coated, and a yellow safelight, which is near in color to the emulsion, makes observation difficult. However, if you repeatedly get a silvery gray in highlight areas of the finished print, the emulsion might have been left out in the tungsten too long, and you might try a bright red safelight. The other cause could be that the emulsion was overheated when you dried it. At all times, protect with an opaque cover, such as the black plastic wrapper sheet film and photo paper are enclosed in, the emulsion you have poured from the brown bottle.

7. Applicators. A labeled soft house painting brushes, polyfoam brushes 1 in. (2.5 cm) or more wide, Hake brush, or Blanchard brush (page 81) are useful tools for coating the solution.
You can dip paper into the solution by pouring a small amount in a glass or porcelain baking pan, which you tilt at a 45° angle. If you use an applicator with metal parts, keep the metal out of the solution, or coat it with clear nail polish. Make sure you do not take up too much emulsion with the brush, because a soaking, rather than a coating, can puddle in spots and take seemingly forever to expose.

Wash and carefully dry brushes between each coating procedure; contaminated brushes can produce imperfections in the print. If you leave a brush with emulsion in light, for instance, the emulsion on the bristles will become exposed, thus contaminating the next coating with darker streaks. Make sure that the brush, and especially a foam brush that holds a lot of water, is almost completely dry before you use it again, or the wash water will dilute the chemistry. Do not use it with other processes.



Lynn Silverman, *A Grove of Four Trees,* 19½ × 14 in., Van Dyke on paper, 1987.

Silverman made a series of brown prints with the subject matter of four trees growing together to form one large leafy mass. Inspired by imaginary relationships between the individual tree and the canopy, she employed masks and "sawing" the four trunks into strips, thereby transforming the grove into architectural or iconic significance.

The glass coating rod mentioned on page 81 saves on chemistry and can yield an almost machinelike even coating on smooth paper, or spray emulsion on with an atomizer.

8. Printing frame. To achieve good contact between negative or flat object and emulsion, use a bought printing frame; plate glass with another sheet of glass, Masonite, or foam core underneath; or follow the instructions for building a frame on page 64. You will be ensuring against blurry imagery. Make sure glass is larger than the image, not the kind that protects against ultraviolet rays, and is clean and dry before each use. Foreign particles lodged in the glass can create dimples in the print. If I am using a printing frame without a hinged back, I create a hinge by using clear tape, as described below in item 17.

If you are using vegetation, such as flowers or leaves, place a sheet of plastic wrap from a grocery store or clear acetate from an art store above the cyanotype emulsion and below the plant life. The heat from the exposure causes the vegetation to "sweat," which can cause stains. Dry and press plants for better contact and, therefore, better resolution. If you do not use glass, carefully pin in place herbage that can blow about or are far from the surface. You also can catch shadows on the emulsion.

9. Brown bottle. A glass quart (1 L) brown fruit juice jar, a recycled chemical bottle, or brown plastic jars sold in photography stores, thoroughly washed and labeled as to contents and date mixed, is fine for storing the emulsion. Use glass if you can, because glass does not absorb the liquid chemicals, and it also enables you to see if any of them precipitates. You can even use a clear glass bottle if you carefully enclose it in an opaque bag, such as the plastic ones in which photographic paper and sheet film are wrapped. Store liquid chemicals in a tightly capped container in a cool, dry area. Be careful to stir, not shake, the bottle, because if it has a metal top, it will eventually corrode from the chemicals and contaminate the emulsion. I have a refrigerator in my studio, where I put the solution in order to extend its life for over a year, but it is important that no children or pets have access to it (see Safety above).

10. Four nonmetallic trays or tubs. You will need labeled photo trays or dish tubs larger than the print when you first wash the exposed paper, fix the image, remove the fixer, and do the final wash of the image. One tray can double as a container for hot water to heat up the distilled water while making the stock solution.

11. Siphon washer. This gadget, available on eBay, works well when attached to a photo tray in a sink for washing prints. Or you can drill small holes up the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains. If you do not have running water, fill the wash tray with water, agitate the print for 20–30 seconds, then dump the water and refill the tray. Keep repeating for 3–5 minutes for a first wash and 30 minutes for a final wash. Blot the print with a clean sponge afterward.

12. Sheet of glass or Plexiglas™ (optional). Angle the glass in a sink, sprinkle it with a little water to form a suction with the paper, then lay the exposed print onto it while you gently develop the image with running water from a hose. This system allows unexposed chemicals to drain off, preventing them

from contaminating the print. Wrap masking or duct tape around the edges of the glass to prevent it from cutting you and to cushion the glass from breaking.

13. Measuring cup or beaker, stirring rod, funnel, 8 oz (250 ml). You will need nonmetallic implements, and the beaker should measure 32 oz (1 L). It is easier to see if the chemicals have gone into solution if you use clear plastic or glass. If you notice a sediment at the bottom of the bottle, pour the emulsion through a coffee filter in a funnel, or you can get black spots in your print.

14. Neoprene gloves, respirator with toxic dust filter. The gloves should be worn while you work, and the respirator should be put on when you are mixing raw chemicals and if you use a hair dryer to dry the emulsion. Gloves can pick up chemicals, so clean them before you touch paper so that you do not leave gloved finger prints.

15. Hair dryer, fan, clothesline, and pins. The emulsion has to be completely dry because if photographic negatives or black-and-white photos come in contact with wet emulsion, a permanent brown stain is created. If inkjet negatives touch liquid, the ink runs. Use a hair dryer on the cool setting or a fan to thoroughly dry the coating before laying a negative on top. Do not use electrical appliances near water. I use nylon screening from the hardware store extended over and stapled to canvas stretchers from an art store as a drying rack in a dark area. A clothesline and pins can be used to air dry finished prints.

16. Newspaper or oilcloth, paper towels/sponge. Because Van Dyke brown print solution stains and can contaminate other prints, cover your work area with layers of newspaper that can easily be removed when dirtied. Oil cloth, available from the Vermont Country Store and Buckaroo's Mercantile (see Supply Sources), is just like the stuff from the 1950s! Frequently wipe it clean.

17. Tape. If you are not using a hinged printing frame, use clear removable tape to form a hinge between the edge of one side of the negative and the substrate. The tape ensures that the negative does not move after you have placed it on the coated and dried paper. Do not press the tape down too hard, or it will lift up the emulsion when you try to remove it later. Cheap tape is better because it does not hold as strongly!

Some of my Museum School students have used thumbtacks, rather than tape, through the border one edge of the negative, then abutted glass up to the tacks. After processing the paper, damp thumbtack pricks can be gently rubbed on the back so that the paper fibers close up and the hole is invisible.

Making the Solution

Equipment You Will Need

Silver nitrate
Ferric ammonium citrate
Tartaric acid
Distilled water
Label
Brown bottle
Beaker
Funnel
Stirring rod
Thermometer
Tub



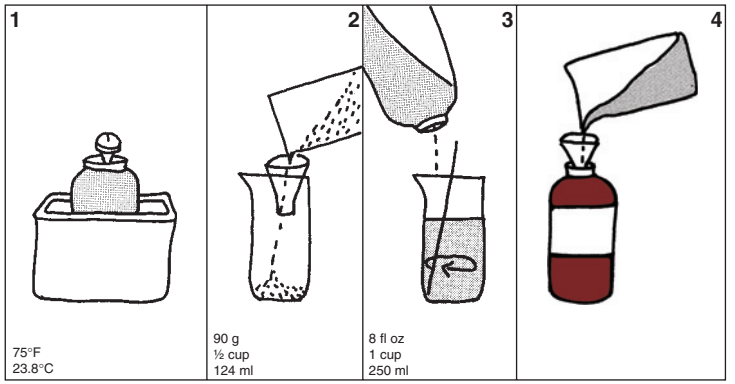
Procedure

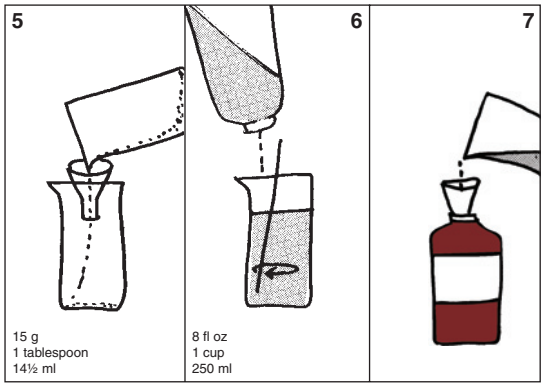
1. Adjust water temperature to 75°F (23.8°C).

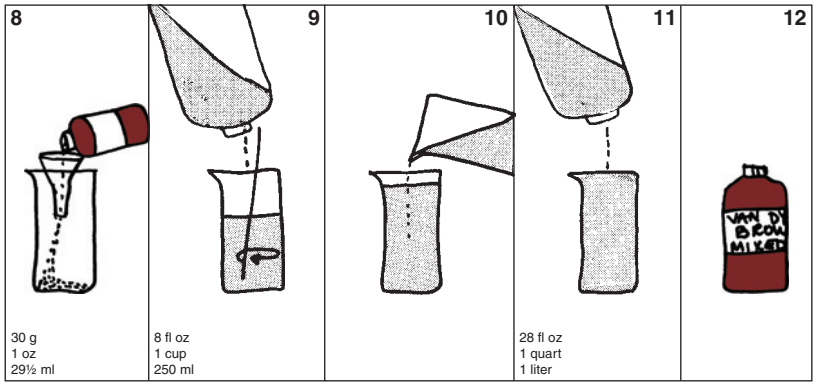
2. Using a funnel, pour 90 g (124 ml) ferric ammonium citrate into a beaker.

3. With constant stirring, add water to make 8 fl oz (250 ml).

4. Pour this solution into a labeled brown bottle.







5. Pour 15 g (14½ ml) tartaric acid into beaker.

6. With constant stirring, add water to make 8 fl oz (250 ml).

7. Add this mixture to the brown bottle containing the ferric ammonium citrate solution.

8. Pour 30 g (29½ ml) silver nitrate into beaker.

9. With constant stirring, add water to make 8 fl oz (250 ml).

10. Slowly pour the mixture from the bottle containing the ferric ammonium citrate and tartaric acid solution into the beaker.

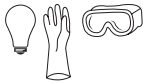
11. Add enough water to make 28 fl oz. (for bright sunlight: 32 fl oz or 1 L).

12. Pour the contents of the beaker into the brown bottle. Cover the bottle and shake the solution to ensure thorough mixing of chemicals. Most brown printers, myself included, let the solutions "age" for two days so that when you use it, the light sensitivity is more stable.

Making a Brown Print



1



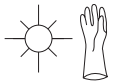
Coating the paper

Shake the bottle of warm solution and pour 1 oz (29½ml) into a glass cup. Dip the end of a brush into the emulsion and lightly apply it to the paper, quickly and lightly moving the same solution around so as to avoid saturating one area. Wet emulsion shimmers. Coat beyond the image or coat an additional small piece of scrap paper for watching the exposure. Let the emulsion sit in a dark place for a few minute before you fan or hair dry on a cool setting.

Or dry the emulsion flat or hang from a clothesline, in a dark and clean area. Make sure that the coating is yellow, because if it appears brown, it has gone bad. Make a sandwich with a board on bottom, dry emulsion side of paper facing up, the negative positioned so it reads correctly, and clean glass on top.



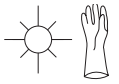
2



Exposing the print

Place the loaded print frame in direct sunlight for 3–10 minutes, or under artificial ultraviolet light 6 in. (15.25 cm) away for 10–15 minutes. Either watch for a little more detail than you desire in the middle tones and yellow-brown in the highlights, or watch the scrap paper turn from yellow to tan to brown, but always turn off the U-V light before you judge the color.

5



Removing the fixer

Dilute the fixer remover according to manufacturer's recommendation for photo paper, pour it into a tray, and immerse the paper for the suggested amount of time. Gently rock the tray for the full time because fixer left in the print can ruin the paper over time.



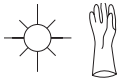
3



Developing the paper

Remove the paper and wash thoroughly with a gentle spray followed by a tray wash until the cool, running water is clear (approximately 5 minutes for thick paper). An option at this point is to increase the contrast with a dichromate bath or to gold or selenium tone the print, as described in Chapter 3 and in the Tips below.

6



Finishing the print

Water-wash the print for 10–15 minutes in a tray fitted with a syphon, or change the water frequently, then blot excess water with a soft, clean sponge and dry in a clean area on racks or a clothesline. The image continues to darken as it dries and oxidizes, so hold back judgment for 48 hours.



4



Fixing the print

Mix fixer according to the manufacturer's recommendation for photo paper then dilute it further by combining in a tray 2 oz (59 ml) of this stock solution with 32 oz (1 L) of water, or use the thiosulfate and ammonia recipe described in item 2 of Materials. Immerse the print for 1–2 minutes. Fixer will darken the image and make it permanent while too long in the fixer can bleach the print. Since it is weak, fixer should be regularly changed when it no longer darkens the image.

Tips

- Store brown print solution in a cool, dry place, such as a refrigerator, and the solution should last for months, even years, if the container is tightly capped.
- Cut the recipe in half if you are not doing a great deal of printing.



Aida Leleian, *Inside These Glass Twigs,*
23-½ × 18 inches, computer-generated negative; image printed on Rives; BFK using Van Dyke brown, gum dichromate, water colors, ©1994.

- Silver nitrate has a tendency to precipitate to the bottom, so stir the solution if it has been sitting (even during the brief time that you are working) and keep it warm, but not hot.
- The deep tones of the emulsion increase if the emulsion ages in the brown bottle from one to seven days after you mix it and before you use it.
- When applying the emulsion, do not brush too hard, or you can abrade the paper. Do not go back, after the emulsion has started to dry, and try to "touch up" the coating. The spot you coated will show up in the final print; where the emulsion is doubled, it becomes darker and a ring around the edge is obvious. Instead, hold the coated paper at an angle as you apply emulsion. You can observe wet areas, which glisten, from dry and uncoated areas, which are more matte.
- If you mix blue or gum with brown printing, the bleach you use as intensifier for blueprinting and dichromate sensitizer in gum solution will fade the brown print. So start with a very dark (overexposed) brown print or do the brown printing last.
- Artist Bill Durgin purposely underexposes a cyanotype, then prints the same negative in Van Dyke brown over it, resulting in brown prints that are a deeper brown—almost black. (Rembrandt often used ultramarine blue and umber pigment, rather than black, in the shadows of his paintings.)
- My students and I have used blue and brown wet, which traditionalists think of as a no-no. However, this combination, when dried and exposed, yields unpredictably exciting colors, like greens and pinks. We do not use bleach or hydrogen peroxide intensifier (for cyanotypes) because it wipes out the brown print, and we do not use fixer remover/hypo clear because it removes the unusual colors. You have to use fixer, however, for the brown print's survival.
- Do not use tools and utensils from other processes with brown printing, or you can contaminate the emulsion.
- A little sensitizer solution goes a long way; 1 teaspoon (5 ml) will coat an 8 × 10 in. (20 × 25 cm) smooth sheet of paper. Overly saturated paper makes for longer exposures and stains.
- Be sure the emulsion is completely dry before exposure, or negatives can stick to it or be damaged, and the finished print will show black stains. Rinse and dry your brush as soon as you finish coating the paper.
- If you hang coated paper or fabric to dry on a clothesline, wash the clothespins and line before the next use, or you may stain future pieces with contaminated solution.
- If you use a standard print frame, unhinge a portion of the back and check one corner of the print for color changes without moving the negative. Exposure is judged visually. With a thin (more-transparent) negative, remove the paper at the tan-brown stage, and with a dense (black) negative remove the paper when it turns deep silvery brown.
- Photographer's Formulary sells potassium dichromate for contrast control (decreasing the middle tones). Approximately 9–10 drops of a 10% dichromate solution is added to a 500 ml water first wash. A 10% solution is made by taking 1 oz of water and slowly stirring in the dichromate until no more can be absorbed and the crystal begins to precipitate out. Then add 9 oz more water. Because potassium dichromate is toxic, it is recommended that you mix the solution in a sink—not your kitchen sink—and wash all the utensils immediately after use. I recommend neoprene gloves. Dispose of

excess dichromate with copious amounts of water down a drain, not in a wastepaper basket. If you want to get rid of any quantity of dichromate, take it to a hazardous waste center; it is one of the worst polluting chemicals.

- If the print is too pale, increase the exposure or use more transparent negatives.
- If the print is overexposed, so that the highlights are blocked up and the brown is too dark, leave the print in the fixer longer than recommended until it comes back to the color you want. Make sure you remove the fixer afterward and thoroughly wash the print. If this procedure does not work, make another print with less exposure or make a denser negative.



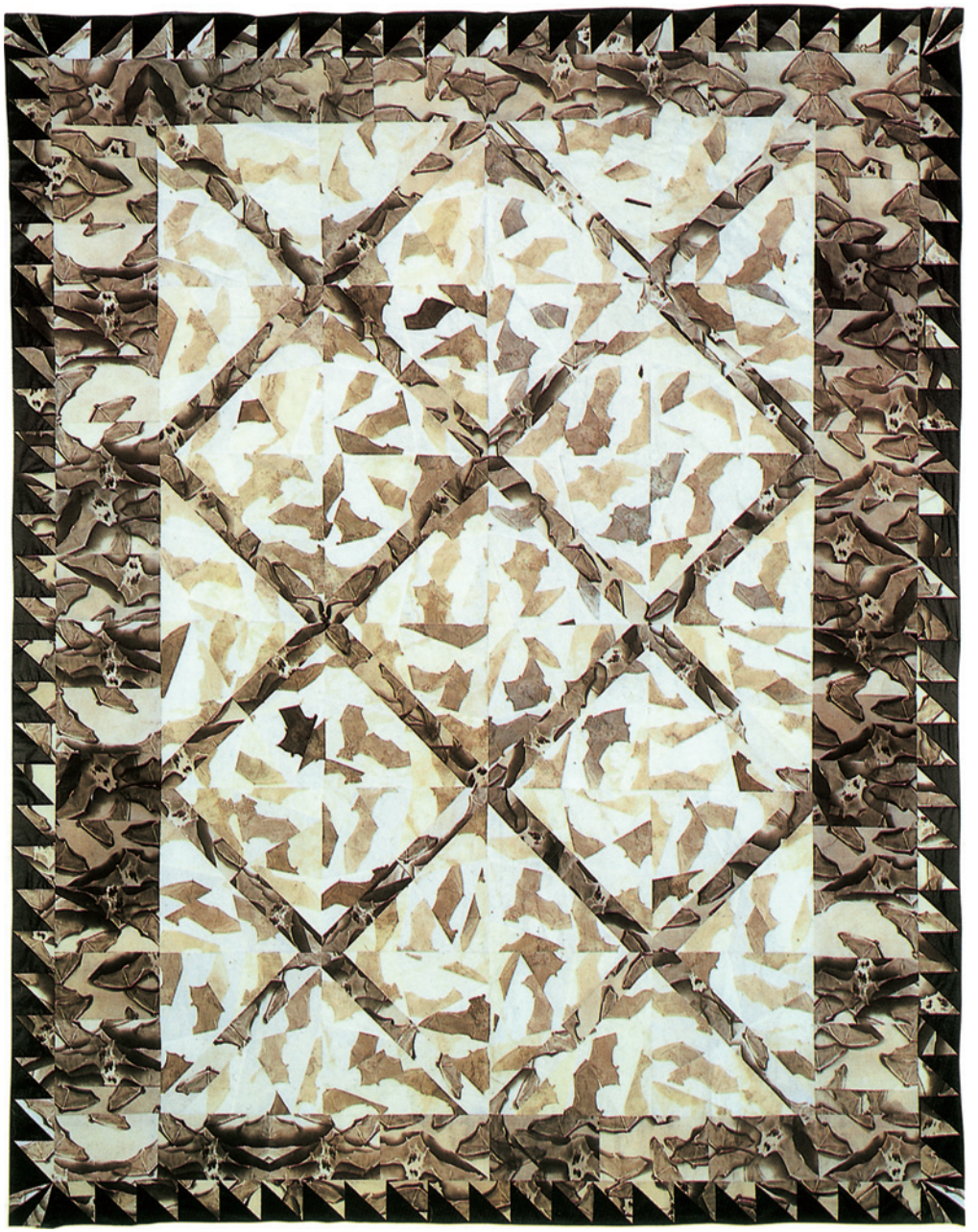
Joan Lyons, (left) *Untitled (Woman with Angel)*, **20 × 16 in., mid-1980s, and (right)** *Untitled (Emulsion)*, **16 × 20 in., mid-1980s, Van Dyke brown print on Arches hot press rag paper. The negatives are 16 × 20 in. Kodalith films exposed on a homemade camera. Lyons usually used the camera with a pinhole (see Chapter 5); however, for these portraits, she fitted it with an old copy camera lens to reduce the exposure time to a minute or so.**

- To remove wrinkles, dampen the back of your dry print with a slightly wet, clean sponge, place the print face down in a hot (375°F or 191°C) dry mount press for 15–20 seconds, or press the back of the print with an iron on the cotton/linen setting. This procedure will darken the print, too.
- See Chapter 3 for instructions on toning brown prints to blue, yellow, copper, and silver after you fix the print. Consider the Photographer's Formulary Gold Toner to warm the brown color or extremely weak selenium toner to darken the brown color, before you fix the Van Dyke print (also in Chapter 3).
- In *Primitive Photography* (see Annotated Bibliography), Alan Greene describes related processes, calotype. and salt prints.

Tips for Brown Printing on Fabric

See the section Cyanotypes on Fabric in Chapter 7 and page 77 for more information.

- Like paper, the fabric can be coated lightly with a brush or dipped in a tray of solution, but thorough drying will take longer.
- Do not air dry the freshly coated emulsion on humid days and nights, or you may get a mottled print.
- Here is a sad story that might help you remember always to fix, then remove the fixer, from fabric. When I was learning these processes in graduate school at the Visual Studies Workshop, I labored many hours creating a brown print quilt from antique negatives, sewing the pieces together, and embroidering detail by hand. I did not fix the image pieces long enough, nor did I bother using hypo clear. I gave the quilt to my parents, who proudly displayed it near their living room window. Six months later all that was left of the quilt was the stitchery and some rotted cotton.
- For more detail in the finished piece, use a warm—not hot—iron on the back of the coated fabric before exposure; in this way, your negative will be in closer contact with the emulsion. You can stretch the fabric to eliminate wrinkles. Use plate glass during the exposure.
- Brown printed fabric can be washed in cool water with mild liquid soap, such as Ivory or Woolite. Avoid detergents and soaps with chlorine or borax.
- Brown prints can be dry cleaned.



Elaine O'Neil *Night Visits,* **72 × 92 in., Van Dyke brown print on cotton, 1985.**
A bat that made its final resting place in O'Neil's attic became the subject for this brown print on cloth, based on the quilt tradition. The artist photographed the deceased animal and used the negatives to print on pieces of cotton, which she arranged and sewed into a complex pattern of light and dark.



Todd Walker, *Untitled,* 7 × 9 in., gum dichromate, 1968.
For many years, Walker used the female nude in this artwork. He manipulated the image through a variety of means, including multiple exposures in the camera, altered enlarged negatives (see Chapter 5), and multiple coatings of light-sensitive pigments in the gum bichromate (i.e., dichromate) process. Walker was an important teacher and innovator, who inspired me, in the short time I learned from him, by his inventive attitude. He started his career as a set designer for RKO Studios in Hollywood, flew for the air corps during World War II, retired from commercial photography at age 50, and began teaching. In 1986, he retired again to pursue digital imaging. Todd Walker passed away in 1998.

Chapter 9

Gum Bichromate Prints

- Materials 189
- Making the Bichromate Solution 195
- Making a Gum Print 196

Gum printing makes water-soluble pigments, such as gouache and watercolors, photographic, producing prints of subtle and wide-ranging colors on paper or fabric. Mixing gum arabic, paint, and a solution of ammonium or potassium bichromate as the light sensitizer, you can create a single or multicolored image ranging from continuous-tone to high-contrast. Gum printing also can be combined with traditional printmaking processes such as etching and drypoint, or with other photo-printmaking techniques from this book. Unlike Van Dyke, cyanotype, and palladium, gum printing creates an actual physical buildup on top of, rather than an absorption into, the substrate. Because the emulsion is delicate, your patience and a willingness to experiment are essential.

One of the earliest photographic processes to be used as a personally expressive medium, *gum bichromate*—also known as *dichromate*—printing is usually credited to a Frenchman, Alphonse Louis Poitevin, whose 1855 experiments using carbon were based on tests with the light sensitivity of dichromates by earlier inventors. The English photographer John Pouncy patented the technique in 1858, for a gum-pigment-dichromate sensitizer, which, when coated on paper and exposed to ultraviolet light under a negative, selectively hardened in relationship to the amount of light allowed through the different density areas of a single negative. The other parts of the sensitizer were not affected by light due to the impenetrability of the negative in those (highlight) areas and they washed off, showing the paper. Some historians say that the process was introduced to the art world by A. Rouille-Ladeveze, whose "photo-aquatint" prints were exhibited in Paris and London in 1894, but the process was recognized as a workable artists' medium through the showing of gum prints by Robert Demachy. In 1897, Demachy and Alfred Maskell published *Photo-Aquatint, or the Gum Bichromate Process*, a book that helped spread its popularity. Simultaneously the American photographer, Edward Steichen, made multicolor gum prints combined with other photo-printmaking techniques (see illustration on page 188). Two groups devoted to admitting photography into the fine-art world, the Linked Ring in London and Photo Secessionists in New York, exhibited in a few galleries and camera clubs. Demachy, Steichen, Alfred Steiglitz, Clarence White, Heinrich Kuehn, and Gertrude Kasebïer also published photogravure reproductions of gum prints in Steiglitz's *Camera Work*. These photographers preferred gum printing because it resembled a painting with its thick, malleable coating, rather than the thin, hard, smooth emulsion of the standard photographic papers, and they turned to the current vogue in painting as their inspiration. Clarence White, for instance, was known to purposely remove gum print details that might detract from a picture in the style of Japanese-influenced images made popular by

painters, especially Whistler, and also Corot and the French Barbizon School.[1] The process lost its popularity after the First World War, usurped by speedier methods and abandoned by Demachy, but many artists still find it a pliable and rewarding process. Todd Walker, whose experimental photographic work has been influential in contemporary times, was one of the important figures in the contemporary rebirth of gum bichromate printing.

Safety

Bichromates (i.e., dichromates) can cause skin inflammation, similar to an allergic reaction, upon repeated exposure. Wear protective gloves and goggles at all times when mixing and coating bichromate as well as when washing a bichromate-sensitized print. Wear a respirator with a toxic dust filter when handling bichromate crystals.

Store ammonium dichromate away from heat and combustible materials.

Bichromates can be poisonous when ingested, even in small quantities. Keep chemicals and chemically-contaminated materials away from your mouth and out of the reach of children and pets. They are suspected carcinogens.

Dispose of excess solution or chemical by flushing it down the drain with a large volume of water, not in a wastepaper basket. Better yet, evaporate the excess, then take this much smaller quantity to a hazardous waste center. If you use a septic system or a well, you should be even more careful to collect the waste in a big drum or trash bucket, or do not practice this technique. Here is what Bostick & Sullivan (see Supply Sources) recommend:

- **Collecting the Nasty Stuff.** This step is particularly important if you are on a well and a septic system! That is not to say you should be dumping it into your municipal system however. The first step is to collect your gum-developing run off. You may wish to collect this in a large tank or plastic garbage can.

- **Converting to Trivalent.** Add sodium bisulfite, sodium sulfite, plain old spent fix or sodium thiosulfate to the solution. The solution will turn from orange to green. Keep adding until there is no more green color and add a bunch more to ensure all is converted. It is now a much safer trivalent chromium compound.

- **Making a Precipitate of the Chromium.** You want to go a step further. Now add an alkali to the solution in the tank or garbage can. You can use sodium hydroxide (plain old Draino works fine) or sodium carbonate or potassium carbonate. After the alkali is added the chromium now is converted to chromium hydroxide which can be filtered out.

- **Building the Filter Thingy.** I have not attempted the filtering step on a large scale as I have not gum printed in several decades. I have however filtered tanks of solution many times before with this system. Here's how I would approach the problem:

  I'd start with a small pond pump. Not a real tiny one but one that costs about $50.00 would be large enough to handle a 50-gallon plastic garbage can. Now buy a house size water filter. They are

[1]Doty, Robert, ed., *Photography in America*, New York: Random House, 1974.

available in any hardware store and are usually blue plastic and are about the size of a 1 liter Pepsi Bottle and cost about $15.00. Next buy the fittings necessary to attach the blue plastic house water line filter to the outlet of the pond pump directly. Install a cheap paper filter into the housing ($3.00–$5.00). Do not use the expensive charcoal filter cartridges as they are a waste of money in this case.

- **Filtering the Tank.** Dunk the pond pump with the filter directly attached into the tank. Plug it in and let it run overnight. It will intake and discharge into the tank. This is less efficient than filtering from one tank to the next but the plumbing is far simpler. I've used this system to filter stuff in tanks in the past. You may have to change the filter two or three times depending on the amount to filter out.

- **Disposing of the Wet Nasties.** When finished put the filters in a 1 gallon Ziploc bag and label the bag "Chromium Oxide Waste." Take the bag to your hazardous waste disposal center.

Inhalation of gum arabic solution or powder can cause asthma, so if you spray rather than brush on gum bichromate emulsion, use a respirator over your nose and mouth.

Certain paint pigments, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermillion, can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a respirator, working in a ventilated area, and carefully washing your hands and cleaning your fingernails after using these pigments can prevent accidentally carrying them to the mouth and ingesting them.

Method Overview

1. Paper or fabric is heavily sized and dried.

2. Under subdued light, the substructure is sensitized with gum bichromate mixture containing gum arabic as a colloidal binder, light-sensitive dichromate and water, and any color pigment, and then dried.

3. The coated and dried surface is placed in contact with an object or negative, and ultraviolet light is shone through the negative. The emulsion hardens and becomes an insoluble colloid in the positive areas where light reaches it.

4. The negative or object is removed. The paper or fabric is developed in water, where unexposed and, therefore, soluble, areas of color are dissolved and wash off, leaving a reversed image to dry and further harden. The image can be manipulated, removing select areas of colored gum-pigment, while wet.

5. One coating must dry before a new layer of the same (for deeper color) or different (to alter the color) gum-bichromate-pigment blend may be applied to the whole or part of the image, exposed under the same or new negative, and processed.



Edward Steichen, *Experiment in Multiple Gum,* **11⅛ × 9⅜₆ in. (282 × 242 cm) gum bichromate print, 1904. Courtesy of The Metropolitan Museum of Art, The Alfred Steiglitz Collection, 1933 [33.43.13].**

Steichen is one of my favorite gum printers because his pictures are not sentimental but offer a psychological encounter with the viewer. His background as a lithographer's apprentice at 15 years of age, training as a painter at the Milwaukee Art Students League, and time living in Europe must have opened him to new ideas, because he introduced Alfred Steiglitz in New York to the then avant-garde work of Picasso, Matisse, and Cezanne. His gum prints of Rodin contemplating his own sculpture, "The Thinker," shows an old man stooped over in meditation. His self-portrait—a photographic print in which he holds a painter's brushes and palette—hints at the seriousness of an aspiring young artist. Steichen retuned to the United States, and, after a successful career as a "straight" commercial photographer (his portraits of Greta Garbo and J. Pierpont Morgan are well-known), eventually became the first director of a museum photography department, at the Museum of Modern Art, where he curated the influential *Family of Man* **exhibit and was the first photographer to be awarded the Presidential Medal of Freedom by John F. Kennedy.**

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1. Image. Low-density (no heavy black) and low-contrast negatives the size of your intended print offer the possibility of a full tonal range in one color after one exposure to gum bichromate emulsion. More often, though, the density of the negative exceeds the range of the emulsion, thus requiring multiple exposures to build up highlights, middle tones, and shadows. Posterized negatives, explained on page 106 and clearly described in Phil Zimmerman's *Options for Color Separations*, listed in the Annotated Bibliography, and color separation negatives (Chapters 5 and 6 and below) offer versatility, because you can create a multiplicity of colors from only three pigments. In addition, high-contrast negatives work quite well. I recently tried printing in alizarin crimson a low-contrast negative over a print in a dark green from a high-contrast negative of the same image. The results yielded a range of colors from deep brown to pink after just two exposures. To ensure that all negatives are exactly the same size, you need to make them during the same darkroom session, using a continuous tone developer for the low-contrast negative and Lith A and B developer for the high-contrast negative (see chart, page 5-89). In addition, try stencils, found objects, torn paper, lace, drawings, and photocopies on acetate. To get more than one layer of color, register negatives as described later in this chapter or in Chapter 4. Negatives made on a photocopy machine and photogram objects will work, too.

You can make color separations on a computer (described in detail in Chapter 6, but still continue to read this section) or with a large-format camera, and they can be used without enlarging to create multiple colored gum prints. Elaine O'Neil, who also made the fabulous brown print quilt shown on page 183, explains how to make color separations in *Instant Projects* (see Baker and London in the Annotated Bibliography), from which the following instructions are paraphrased:

- First set up a still life or select a scene that will not change between exposures. Include a color control patch and a gray scale, available from a good photo shop. Position the patches and scale at the edge of the film format so that you can later trim them off. Or, make two sets of negatives, one with and one without the patches and gray scale. Next, determine a basic exposure for the scene and expose black-and-white film accordingly. If you use a Polaroid back and Polaroid black-and-white film you can examine the gray scale in the negative; it should have good separation in both shadows and highlights. Adjust the exposure, if necessary.

- Make three additional exposures with three additional sheets of Polaroid or similar ISO black-and-white film, increasing the basic exposure as indicated below if the illumination is from daylight or electronic flash. Use a #47B blue filter over the lens and add 2⅔ stops. Through #58 green filter add 3 stops. Through a #25 red filter add 3 stops. With tungsten illumination, which is richer in red light, increase the red filter exposure only 2 stops. These filters are special order items from a photography store. As soon as you peel the Polaroid film from the negative, clip the corners of the negatives so that you can identify them after clearing (e.g., clip one corner for the blue-filtered negative, two corners for green, and three corners for red).

- Evaluate the exposure of the negatives by examining only the middle value (18% gray card or Zone 5 on the gray scale). It should be the same density in all three negatives. If the value is not the same, adjust the exposure and reshoot. The color areas in the scene will change in density depending on the color of the filter. (If you are using Polaroid film, clear the negatives as the manufacturer instructs. Otherwise, develop your sheet film as normal.) With a tricolor gum print, the blue filtered negative will be used to print the yellow emulsion layer, the green-filtered negative will print the magenta layer, and the red-filtered negative, the cyan layer. Alizarin crimson, cadmium yellow light, and thalo (nonastral) blue approximate the three primary printers' colors for use with color separation negatives.

- The unfiltered negative is used only to check exposure, although I sometimes use it to print a first layer of underexposed black or Paynes gray so I can see succeeding layers for registration.

Even if you are making digital color separations, the understanding of how this process is done with film is helpful because it teaches you the conceptual foundation and to evaluate color separation negatives based on the middle grays. Remember: you have to keep inkjet negatives absolutely dry, or the negative's image washes off.

2. Chemicals. You will need premixed gum arabic 14° Baume, available usually in one-gallon (3.8 L) jugs from offset lithography/commercial printing suppliers. In addition, small quantities—enough to last for quite a few print sessions—are sold in art stores under the names Winsor & Newton or Grumbacher gum arabic for oil painting and from Photographer's Formulary. Although gum arabic is available and less expensive as a powder, it is time-consuming and more of a health risk to mix. Do not heat gum arabic solution, so use it and store it away from heat and strong light. I have found that if the gum ages to a very dark brown, it greatly lengthens the exposure time.

I have read of a 20% solution of 88% hydrolized PVA (polyvinyl alcohol without vinyl acetate) and water being used instead of gum arabic. After letting the mixture stand for 20 minutes, it is heated to no higher than 122°F (50°C) with continuous stirring, at which point the PVA should appear clear. Any undissolved grains can be strained through a double layer of cheesecloth in a funnel. Incidentally, a form of this PVA method with ammonium dichromate is used as a photo ceramic technique on bisque ware and as an emulsion for photo silkscreen. Any user of these components should check the health hazards associated with them, and the Annotated Bibliography of this book lists appropriate organizations and books.

You will also need either potassium or ammonium bichromate, which can be purchased as a dry crystal in 1-pound (0.5 kg) or smaller bottles from suppliers listed in Supply Sources. Ammonium bichromate is preferred for its greater sensitivity to ultraviolet light, but using it means you have to be more careful about fogging the emulsion through accidental light exposure or letting the sensitized layer sit too long or become too hot (gum prints grow to be more sensitive the minute the coating is dried or heated).

Proper mixture, exposure, and development should avoid staining problems in the finished print, but a bath of 5% potassium alum and distilled water may help clear it. This bath also hardens the gum emulsion, a result especially useful with multiple coatings. Some gum printers use a 10% solution of potassium metabisulphite or sodium bisulfite for five minutes. Clear the prints individually, as the emulsion is quite delicate and you will want to watch the action on each one and prevent one print from damaging another.

You can also use plain gum arabic around the borders before you start printing, and it will act as a mask to keep pigments and dichromate from staining that area.

3. Pigments and pencil. Professional or artist-grade watercolors or gouache in tubes work best. The quality of the pigment, as well as the color, can make a difference if you want to avoid staining on your paper. I always advise my students: this is what you love, so don't scrimp by buying inferior grade art supplies. Instead, pack your lunch and eat dinner at home this week! Watercolors produce more transparent coatings and can create a variety of colors with just a few pigments, whereas gouache renders a more opaque deposit and could be more suitable for the base or for a single coating. Liquid tempera colors have been used with success, but they tend to separate into fine particles, producing a grainier look to the gum bichromate print. Make sure that the pigment you use has no chromium in it (such as chrome yellow) because it reacts negatively with the bichromate. Cerulean blue seems to be difficult to use. Pigments tend to be more permanent than dyes, but some colors last longer than others, and a good art store should be able to inform you about stability.

Alizarin crimson, cadmium yellow-light, and thalo (nonastral) blue approximate the three primary printers' colors for use with color separation negatives. *Keep copious notes with pencil on the back of the print*. Include information about the density of the negative, type of sizing and paper, color and proportions of sensitizer, and exposure method and time. You can also use a pencil to mark the image area before you coat the paper.

4. Distilled water. Sometimes tap water is fine for making the bichromate solution, but distilled water eliminates the frustration of possibly mixing bad solution. A tub filled with hot tap water can be used for warming the distilled water.

5. Receiver and sizing. Finished prints should be rendered on rag paper with a slightly toothy texture for the mixture to cling to, medium absorbency, and resiliency in repeated water baths, such as Strathmore Artists Print paper, Arches Aquarelle 300 gsm water color paper block or Lana. I am such a fan of Platine that I even use the back of it (a slightly rougher surface) because Platine is the brightest white you can find without optical brighteners and it is internally sized the way I like. The backs of more textured papers (even the backs of fiber photographs) can be used for higher contrast work. Practice prints can be made on less expensive paper. Some gum printers use white or other pigments lightened with white on dark paper. BFK, which comes in black and dark brown, is particularly suited to this dramatic approach. Or you can brush cyanotype, palladium, or brown print solution on white paper, expose it to ultraviolet light without a negative, process the paper, and get a sheet of solid deep blue or brown paper with a long exposure and a sheet of pale colored paper with a short exposure.

Sizing fills the pores of the paper so that the color stays on top, rather than sinks in too deeply, but sizing can also affect the color of the finished gum print. Unless you use the diluted acrylic polymer size by itself, all paper should be sized (see page 79) with a method that uses hot water because you will also be preshrinking the paper, an important preparation for more than one gum print coating. Otherwise, you need to preshrink paper by floating it for twenty minutes in 104°F (40°C) water, then hanging it without weighting it to dry, or drying it flat on clean screens. In an article entitled "The Gum Print," in *Darkroom Photography* (Oct. 1986), James Collins, suggests the following method: Size the paper, then air dry it. Apply the gum bichromate emulsion to an area about 1 in. (2.5 cm) larger on all sides than the image, and hang the paper in front of a cold-air fan to dry. When the emulsion is just barely tacky to the touch, put two pencil dots 12 in. (30.5 cm) apart and about ⅛ in. (5 mm) inside the emulsion edge. Hold a hair dryer about a foot (30½ cm) from the paper (I hold it closer), and evenly blow warm air (I use hot air on the back, too) over the paper until it has shrunk the paper by ⅛ in. (5 mm) and the pencil dots measure 11⅞ in. (30.25 cm) apart. Make the exposure, develop the image, and repeat this coating and preshrinking procedure with each application of emulsion.

My personal routine is always to use a sheet larger than the image size so I can take notes and register negatives outside the picture. First I use the alum and spray starch method described on page 80, then I use 1 layer of acrylic matte medium diluted with 6 parts water between each color to prevent light areas from staining. You can even tint the first layer of this diluted sizing with acrylic paint if you want a pale color to work on. You can finish a print with gloss medium over the last color to make an even more lustrous appearance than the gum arabic in the formula already provides. When I use the back of Platine, I need only use spray starch by itself; I spray and then lightly sponge brush two coats in opposite directions, letting each coat dry before I apply the next. I employ this simple procedure before each layer of color, measuring for shrinkage as described in the previous paragraph.

The other sizing methods (see pages 4-80) work for numerous coatings, but be aware that the highlights become tinted with pigment. The acrylic polymer medium method works best for up to four gum print layers. My students have found that if you alter the instructions by mixing 1 part polymer medium with 8 parts water, you can build up more layers and keep the highlight areas bright, but the paper eventually becomes stiff. Therefore, rather than use sizing, another student has experimented by using white gouache, which is more opaque than watercolors, for the first coating, exposing, and processing it without a transparency. Then she proceeded with normal gum printing.

Because sizing paper and fabric is necessary, messy, and time-consuming, you will find it more practical to size several pieces of paper or fabric at once. Keep all implements and surfaces clean and size the substrate's side to which you will apply the emulsion.

I find that, no matter what paper or technique I try, there is a limit to the number of layers that will sit on the surface. Although some practitioners claim to create six coatings, I cannot seem to get above four with any success.

Other surfaces that work are those with a tooth, such as the dull side of aluminum lithography plates, the matte side of frosted acetate, sand-blasted glass and plastic, and roughed up metals. Tyvek™, which is spun plastic that looks like rice paper, works well. It is sold at home-improvement

stores as an insulating barrier against water or you can take apart a waterproof Tyvek™ envelope purchased from a stationer.

Preshrinking in hot water to also remove the manufacturer's sizing, which is counterproductive for our purposes, and surface sizing fabric is important. Natural fabrics, such as cotton, canvas, and linen can be used with gum bichromate printing. I have used gessoed painters' canvas, which eliminates the need to surface size. Practice first on paper, since imaging on cloth is a technically challenging way to work.

6. Ultraviolet light. You cannot see a great color change after exposure and before development, unlike with cyanotype or Van Dyke brown printing. Artificial light such as sunlamps, photofloods, or fluorescent ultraviolet tubes (how to build an exposure unit is detailed in Chapter 4) allows the exposure to be exactly timed and is not affected by the weather, the time of year, or the time of day. A typical exposure in my studio is 6 minutes. However, indirect sunlight can be used; avoid direct sunlight, where bright radiant heat output can cause the emulsion to fog with exposures over five minutes.

I illuminate my studio with a 40-watt tungsten bulb 4 ft. (1.22 m) away, and I have never noticed a problem.

7. Applicators. Try fine flat bristle brushes, hake brushes, or nylon paintbrushes about 1 in. (2.5 cm) or wider for an 8 × 10 in. (20 × 25 cm) image. A sponge brush or foam paint roller from the hardware store is a good alternative, and if you use an atomizer or air brush to apply the emulsion, be sure to wear a respirator and work in a well-ventilated area. A dry Blanchard brush (see Chapter 4) or a second foam paintbrush helps blend in and buff the strokes made by the coating brush. The width of the brush will be determined by the area you want to coat. A soft round traditional watercolor brush comes in handy for coaxing the development of the print in water. Keep the metal part of the brushes away from the bichromate or coat the ferrule with clear nail polish.

8. Brown bottle, opaque 35 mm film canister, or pill containers. A clean, recycled fruit juice jar or dense plastic jar (optional), in case the recipe is doubled or tripled. Otherwise my instructions call for recycling opaque plastic film canisters or pill bottles. Are you glad to finally find a use for those empty film and pill containers? They are perfect for storing the mixed gum bichromate solution because they are light tight and spill-proof.

9. Printing frame. Use plate glass that does not block ultraviolet light with Masonite, another piece of glass, or foam core underneath, or follow the instructions on page 64 for building a frame. A frame with a hinged back is not needed because during exposure you cannot really see when the exposure is right.

10. Two trays or tubs. You will need glass or porcelain trays larger than the print when you develop the image and fix it. You may also want a third tray for a stain-remover bath and a fourth tub of hot water to keep the bichromate solution warm.

11. A four oz (114 cc) measuring cup and spoons, paper cups or shallow glass bowl or saucer, stirring rod. The small, clear-plastic 1 oz (30 ml) medicine measuring cups available at a pharmacy or measuring spoons are also helpful. A shallow glass bowl, such as a pudding dish found in a grocery store, or a glass saucer from the next-to-new shop, is helpful because you can place it on top of a

ruler in order to measure the length of the link of pigment and can see through the bottom to make sure the solution is thoroughly blended. Avoid stirring rods that can break or chip and *wash and dry all equipment, including brushes, in water after each layer.*

12. Pencil and timer, watch, or clock.

13. Household bleach (optional). Severe overexposure causes pigment stains that can be removed by adding a few drops of laundry bleach to the first water bath. You can also use this bleach and water mixture with Webril Wipes (see Philben in Supply Sources) or cotton swabs to gently clean up borders after you finish printing. Selective areas can be lightened with a sharp typewriter eraser applied gently on a dry print. With both methods, you have to be careful not to abrade the paper.

14. Protective gloves, respirator mask.

15. Two registration pins, masking sheets, masking tape, ½in. (1¼cm) heavy black tape, ruler, hole punch, scissors, stencil knife (optional). Gum bichromate printing yields subtle colors, and usually one coating with one exposure is not enough. If you are using more than one negative with multiple coatings and exposure, see Chapter 4, Creating the Photo-Printmaking Studio, which describes a tried and true registration system (see page 67) using registration pins and a hole punch of the same diameter. Another option that ensures image alignment when using the same negative with multiple coatings and exposures requires cutting four strips of heavy black tape 1 in. (2.5 cm) long. Affix a tape strip to the center of each of the four edges of the same negative, beyond the image area. Trim the excess so that the tape is flush with the film, and with a sharp hole punch make a half-circle notch in each of the taped edges. If you coat the paper with gum bichromate emulsion beyond the image area, the hole punch method will provide a dark half-circle on every side of the print after exposure. You can line up the notches in your negative with these half-circles for subsequent exposures.

A method that Richard Sullivan, of Bostick & Sullivan (see Supply Sources) recommends requires cutting a piece of Formica several inches larger than the paper, obtaining registration pins and Berkeley or other company registration tabs (self-sticking 1 in. square Mylar with hole punched in one end) and double-backed carpet tape. He suggests taking your paper and dry mounting it to the center of the Formica or heat-resistant plastic. Degrease one edge of the board next to the paper with isopropyl alcohol. Cut a piece of carpet tape a little larger than the registration pin and first stick it to the pin then stick the unit onto the degreased Formica next to the paper. Repeat this process with the other pin and stick it a few inches from the first pin on the degreased margin of the board. Next take each of the tabs and put them onto the registration pins with the sticky side up. Carefully attach the negative, emulsion side up, to the sticky part of the tabs. You will use the negative emulsion side down, however. Remove the negative. Coat the paper with the gum bichromate solution, Sullivan advises, light on pigment and underexpose it beneath the negative, which has been inserted onto the pins. Remove the negative. Process the paper still attached to the Formica, and build up layers, sizing and drying in between. When you are finished, stick the board and print in a hot dry-mount press, quickly peel up one corner of the paper, and strip it off the Formica. You can reuse the board and pins.

16. Hair dryer with warm and cool settings.

17. Newspaper, paper towels, and kneadable eraser. Cover the work area with newspaper. Discard sheets as they become soiled. Blot the coating brush with paper towels. Use a kneaded eraser to pick up debris from the dried and unexposed emulsion layer.

Making the Bichromate Solution



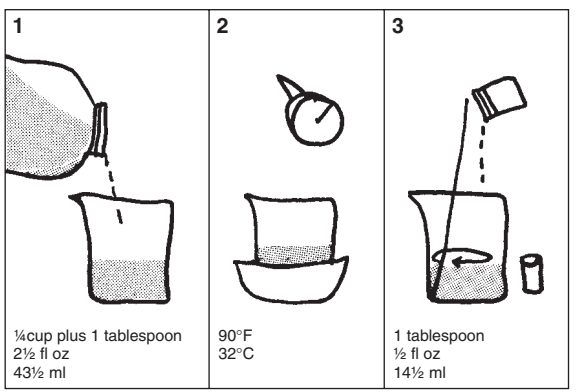
Equipment You Will Need

Ammonium bichromate crystals
Measuring cup
Stirring rod
Distilled water
Plastic film container or pill container
Paper cup or saucer
Thermometer
Tub of hot water



Procedure

1. Pour ¾ fl oz (20 ml) water into measuring cup.
2. Adjust water temperature to 90°F (32°C).
3. Measure, then pour ⅛ fl oz (5 ml) ammonium bichromate crystals into the measuring cup, stirring constantly.
4. Pour the bichromate solution into a film canister. Allow it to cool to room temperature.



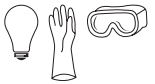
Tip for Making the Bichromate Solution

■ You can double or triple the following recipe if you plan on doing a lot of printing, because the bichromate stock solution has an indefinite shelf life when stored in a cool, dark place. Should the crystals separate from the water, they will reblend when warmed to 90°F and stirred.

Making a Gum Print



1



Mixing the emulsion

Squeeze a ½ in. (1.25 cm) link or worm of watercolor pigment into a paper cup or plate. Add ½ teaspoon (2.5 ml) of gum arabic, and thoroughly mix the two. Stir in ½ teaspoon of bichromate solution. Dampen the coating brush, then blot it on paper towels.



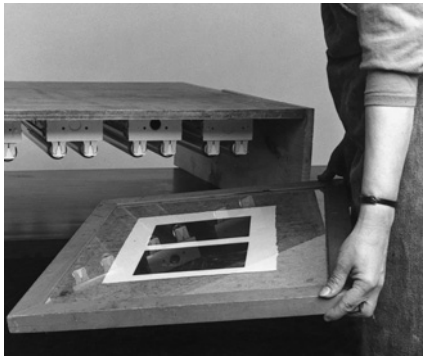
2



Coating the paper

Use the emulsion to coat an 8 × 10 in. (20 × 25 cm) piece of paper by pouring it from the cup onto the sized paper and quickly working that emulsion on evenly and lightly with a brush out to an area beyond the image. The emulsion will not look like the watercolor pigment at this point but will have a yellow-orange tint to it. When the emulsion feels tacky, gently smooth the coating with a clean, dry brush.

Air dry in the dark or use a hair dryer on the cool setting. When the emulsion is dry, make a sandwich with the exposure frame or backing board on the bottom, the paper with the emulsion facing up next, the negative reading correctly on the paper, and clean glass on top.



3



Exposing the print

Place the loaded print frame in the shade for 10–30 minutes, under a sunlamp or photoflood bulb 3 ft (1 m) away for 3–12 minutes, or under ultraviolet fluorescent bulbs 6 in. (15.25 cm) away for 6–15 minutes. Exposure times vary according to the light source, pigment color, and pigment density. You will have to experiment and keep notes.



4



Developing the paper

Because the reaction that occurred during exposure continues after the emulsion has been removed from light, immediately place the paper face down in a tray of warm—near 90°F (32.22°C)—water. Development, a delicate process, takes from 10 minutes to overnight and consists of floating the paper in warm water that you change often. While the print is developing, you can lighten areas of it by rubbing very gently with a soft brush or cotton swab, but be careful because the emulsion is fragile and severe agitation can remove the image altogether. If the water becomes tainted, gently move the print to a tray or 80°F (26.67°C) water.

5



Fixing the print

When development is complete, the unexposed areas of the emulsion dissolve and float off the paper, leaving the exposed areas the same color as the pigment you used. Transfer the print to a tray of cool water for 15 minutes then air dry flat or use a hair dryer as described above or fan dry. With the polymer medium method, resize the dry print before adding a new coating of emulsion. With the alum/spray starch method alone, resize with a new layer of starch.

Tips for Making a Gum Print

■ Before you mix the gum bichromate solution, you can get a sense of how the colors will combine after you print different layers. Take a piece of paper the same color as you will be printing on and a brush, mix a dab of each color with water, and layer the liquid colors in the order you were planning to use them. Be sure to let each color dry before you add the next. Or, use transparent rag velum, brush the color of the next gum layer on the velum, which is secured on top of the print.

■ Write down every detail of your printing method so that you can be consistent when you work because precision is not easy. After all, a 1 in. link from a small tube of watercolors will not be exactly the same as a 1 in. link from a large tube and the density of the earth colors tends to be thicker than that of other colors, but the recipes still work. In addition, write "top" outside the image area because sometimes, after you coat a dark color, you cannot see the underlying picture.

■ The following, a slight departure from the method described in item 15, is a system that I find useful for making sure that after each soaking, when the paper changes size, I bring the sheet back to its original size so that the negatives can be registered: I make a mark on the front of the paper with a sharp pencil point at 1 in. (2.5 cm) and 8 in. (20 cm). The marks are outside the image area but within the coating area. I always use a hair dryer to dry the paper. First I use heat on the back, and I keep remeasuring with a ruler until the pencil marks are back to their original length. Then, I change the hair dryer setting to cold and make sure the front is completely dry.

■ You must thoroughly mix the pigment with the gum arabic and bichromate solution (see step 1), or the emulsion will be streaked. Improper sizing, such as the gelatin method without a hardener, or too much pigment can cause stains in the developed printing paper. Remember, a dichromated solution will continue to lose sensitivity over time or when stored in heat or humidity, so you must use the mixed emulsion as soon as you can.

■ The recipe described in step 1 on page 196 works better for one-, two-, or three-coating prints, as it renders relatively strong shadows, good middle tones, and clear highlights (although gum prints are pale after just one exposure). An emulsion of a ½ in. link of pigment and ½ teaspoon gum arabic with 1 teaspoon bichromate solution shortens the exposure time and is better for halftone negatives, more than three coatings, and printing on fabric.

■ If you are going to use the same negative repeatedly, build up your image by making exposures for highlight, middle tone, and shadow areas. A good working method is to divide your gum-pigment solution into three densities:

Light: 1 in. (25 mm) link pigment to 1 teaspoon gum arabic and ½ oz bichromate solution.
Medium: 2 in. (51 mm) link of pigment to 1 teaspoon gum arabic and ½ oz bichromate solution.
Dark: 4 in. (102 mm) link of pigment to 1 teaspoon gum arabic and ½ oz bichromate solution.
Use the lightest solution for the first and longest exposure—this will give you highlights. For the middle tones, lessen the exposure by 1–2 minutes and use the medium solution. For the shadows, reduce the exposure again by 1–2 minutes and use the dark solution.



Jonathan Trundle, *Dud's and Suds Laundromat, Murfreesboro, TN—Self Portrait*. **Three-color gum dichromate print. 14 × 18 inches on 16 × 20 inches sized Rives BFK, 2005. The image originally was shot on 35 mm E6 slide film. Trindle color separated the positive image in the dark room with red, green, and blue glass filters projected onto sheets of film used for X-rays. Then, the three different negatives were printed in the following order: Cyan, Magenta, Yellow.**

■ Because gum bichromate colors are translucent, better tonal separation and color subtlety can be achieved by multiple printings. Also one printing usually produces weak color. If you have a set of color separations, apply the yellow layer first with the blue-filtered separation negative. You may have to repeat the yellow because it is such a light color to begin with. Next print with magenta pigment and the green-separated negative. You may need to coax the magenta off a bit in the deep shadow areas with a soft brush during development so the print does not end up too magenta. Last, use the cyan pigment with the red-separated negative, possibly brushing off any blue that printed in the highlights. You can add a last layer of black to deepen the shadows.



Registering the negative with push pins. Print rests on paper towels.

■ A less exact, but easier, method for registering negatives is to use pushpins through the four black borders of the negatives after you have aligned them on a light table. First, fasten the one negative to the light tabletop with transparent tape. Then, align and tape the next negative on top. Continue in this way until all the negatives are in position, then push the pin through all four negatives at once. You can use a paper towel behind the negative so that you do not mar the light tabletop. As you print, push the pin through the previously made holes in each negative, through the paper, and into a backing board. With this method, you use the same small hole in the paper made by the pushpin and use glass only as large as the edge of the image. In addition, you can line up the negative and the paper with a pushpin, lightly tape the two together beyond the image area, remove the pushpins, and put the unit in a print frame.

■ The emulsion may be applied to the entire sheet of paper or only to specific areas. To make a smooth coating, use a foam brush and apply in quick, even strokes; for texture, use uneven



Four stages of a color gum bichromate print. Image and Photo by Youngsuk Suh.

strokes and a bristly brush. A foam roller can give either a pointillist effect or a very smooth surface, depending on how much pressure you exert. You can use quite a bit of "muscle" to make sure that the gum-pigment-dichromate emulsion is applied so evenly that no brush marks or air bubbles remain. However, you must work quickly or the emulsion starts drying, then you cannot move the emulsion much. Do not worry if a few hairs come off as you coat the emulsion; you can pick them off a dry print after each coating, and they will not leave a mark.

- Do not apply too thick a layer of emulsion, because a heavy coating obstructs the exposure (meanwhile, a thinner coating gives better detail). Rinse and dry your brush as soon as you finish coating the paper.

- Too much heat from a hair dryer will cause the bichromate to harden and become insoluble in water.





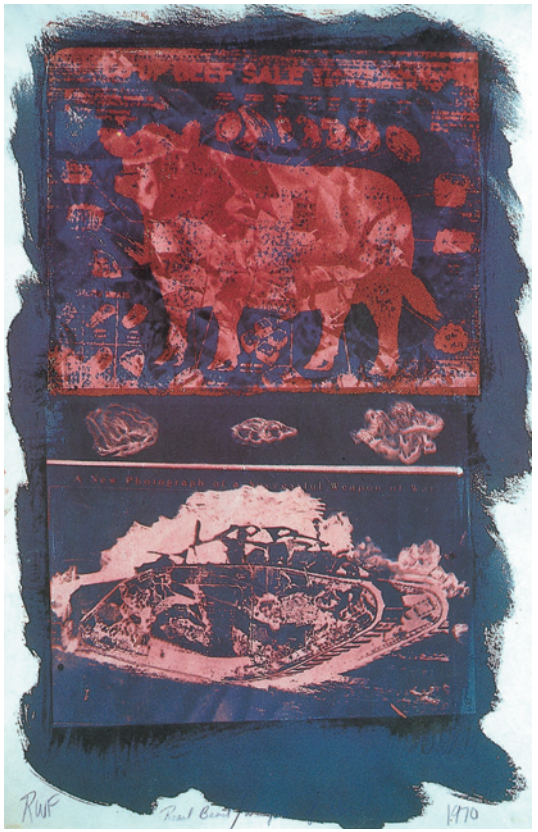


Sookang Kim, ***Bojagi—Wrapping Clothes*****, Gum bichromate print on Rives BFK rag paper, 50 × 60 cm (20 × 24 in.), 2003. Inspired by the Korean tradition using cloth for wrapping all sorts of packages—after all, there were no paper bags—Kim has used the same analogue negative to print up to 12 layers of gum bichromate color. These are 3 out of a series of 20 images.**

- Because the emulsion becomes more sensitive to both light and heat as it dries, coated papers do not store well, and the emulsion will harden with time. Coat only as many sheets as you plan to use at one printing session. The three-part emulsion will not store well, either; so mix just enough emulsion to use, coat it immediately, and discard the rest.

- Avoid working in extremely humid conditions because the bichromate solution soaks up moisture from the air and becomes less sensitive.

- Exposure times for gum printing must be determined by testing, so before you start to work on an actual print, you can reduce future frustration by running the following test: Coat with emulsion and dry a sheet of paper. Cut this sheet into 2½ in. (6 cm) strips, marking each strip to indicate the emulsion used. Using a different strip but the same part of the negative, make separate exposures of different lengths of time, being sure to mark the exposure time and light source on each strip. Develop, dry, and evaluate each test for each emulsion used. Keep a notebook with these test strips for future reference. When I use the fluorescent exposure unit described in Chapter 4, I find a 6-minute exposure to be a good starting point with "normal" negatives.



Robert W. Fichter *Roast Beast/Weapon of War,* **50 × 32.3 cm. cyanotype and gum bichromate print, 1970. Collection of the artist.**

A series of political and social commentary was created by Fichter through the combination of historical and contemporary public imagery in the cyanotype (blueprint) process. Additional color was obtained through gum bichromate printing (see Chapter 7) and other artists' media.

- Do not worry if you cannot see a latent image on the coated paper after exposure and before development. Sometimes you can see one, but either case is not a sign of a correct or incorrect exposure.

- If the image was overexposed or the light source was too hot, the emulsion will harden and will not wash off. If the image was underexposed, the emulsion will float off. If you used too thick a coating or too much pigment when applying the emulsion, the image will flake off. This problem is exacerbated with multiple coatings.

- Make sure the developing tray is full of water—if the gum print scrapes the bottom of the tray, the image will rub off.

- You can remove some stains by floating the print in very hot water for 5–10 minutes, but be sure to place the print in cold water immediately afterward for the final rinse. Do not be confused if you are using more than one color per coating: you should wash the yellow dichromate stain after each coating, but the highlights with detail may have yellow pigment in them, if you used that color.

- Gum works beautifully under liquid enlargement emulsions (see Chapter 13) and over brown or platinum/palladium prints. My personal favorite is gum over cyanotype, but the dichromate in the gum tends to bleach the blue, especially with six or more coatings. Therefore, start with a slightly overexposed blueprint and size with the polymer method before you coat the gum bichromate solution.

- If a cap on a tube of paint sticks, you can loosen it by holding a lighted match under the cap for a few seconds. Clean the threads with a tissue, then apply a little petroleum jelly to the ridges to avoid this problem again. If the paint has dried up, just remove a hunk of it by cutting the bottom or the tube, then soak the dried chunk in a little distilled water until it softens. These are old art school tricks that I was reminded of by Judy Seigel.

- Rockland's SelectaColor for paper and Pebeo's Setacolor Soleil fabric paints are dealt with in similar ways. The Rockland colors are composed of a more permanent pigment base, which you coat on paper and expose under a contact-size negative, then sponge develop. The Pebeo paints, which are less fugitive than dyes and come in 34 light-sensitive colors, can be applied to either natural or synthetic fabric and used wet. You contact print objects (e.g., leaves, shells, cheesecloth) directly on top of the light-sensitive paints after they have been coated on cloth, and put the setup in the sun or under heat lamps. When the fabric dries, you have a print without any further processing. Once the fabric is heat cured, it is wash-fast and color-fast and can be dry cleaned. Made in France, the dyes and instructions for their use are available in the United States at a discount from Fabrics To Dye For (see Supply Sources).



Laura Blacklow, *Untitled,* from *Territories* ©, 6¾ × 4⅝ in. (172.5 × 11.75 cm) altered casein print, 1978.
I chose casein printing for this image because it is a delicate process, which creates subtle colors and forces me to slow down as I work. Some of the color has been made by building up casein coatings of different hues, each of which was printed with a negative. Some of the color has been achieved with casein coatings and no negative, while other hues come from colored pencils.

Chapter 10

Casein Pigment Prints

- Materials 204
- Making the Bichromate Solution 206
- Making a Casein Print 208

This process, which utilizes curdled milk to bind the component materials, was patented in 1908 as a technique to use with other photo-printmaking methods, such as Van Dyke brown printing (see Chapter 8). Used by itself, however, *casein printing* can yield as subtly graded, colorful results as the watercolor paints that make up part of the emulsion. The translucency of each color coating permits a new hue in a new layer of emulsion to change the pigment color underneath. One of the least expensive of the hand-applied emulsions, casein printing is closely related to gum bichromate printing (see Chapter 9), and a reading of that chapter is recommended.

Safety

Bichromate (also called *dichromate*) can cause skin inflammation, similar to an allergic reaction, upon repeated exposure. Wear protective gloves and goggles at all times when mixing and coating bichromate as well as when washing a bichromate-sensitized print. Wear a respirator with a toxic dust filter when handling bichromate crystals.

Bichromates can be poisonous when ingested, even in small quantities. Keep chemicals and chemically-contaminated materials away from your mouth and out of the reach of children and pets. Bichromates are suspected carcinogens.

Dispose of excess solution or chemical by flushing it down the drain with a large volume of water, not in a wastepaper basket.

Certain paint pigments, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermillion, can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a respirator, working in a ventilated area, and carefully washing hands and cleaning fingernails after using these pigments can prevent accidentally carrying them to the mouth and ingesting them.

Method Overview

1. Paper or fabric is preshrunk, sized, and dried.

2. Under subdued light, the paper or fabric is coated with casein pigment emulsion and allowed to dry.

3. The coated surface is placed in contact with a negative or object, and ultraviolet light is shone through the negative.

4. The negative is removed. The paper or fabric is developed in water, where unexposed areas of color are dissolved, leaving a reversed image to dry and harden.

5. One coating must dry before a new layer may be applied, exposed, and processed.

Materials

Please read Chapter 9 on gum bichromate printing, as these two techniques have similar requirements.

1. Image. Negatives the same size as the print you wish of low density (not heavy black) offer the possibility of full tonal range after one exposure to casein pigment emulsion. More often, though, the density of the negative exceeds the range of the emulsion, requiring multiple exposures to build up highlights, middle tones, and shadows. Posterized negatives described on page 106 or color-separation negatives explained in Chapters 5, 6, and 9 offer versatility. High-contrast negatives also work quite well. If more than one printing is desired, negatives will need to be registered, as described later in this chapter and in Gum Printing.

Try stencils, found objects, torn paper, lace, drawings, and photocopies on acetate.

2. Chemicals. You will need either potassium or ammonium bichromate, which can be purchased in 1 lb (0.5 kg) or smaller bottles from merchants listed in Supply Sources. Ammonium bichromate is preferred for its greater sensitivity to ultraviolet light.

Instant powdered milk, available in grocery stores, provides the casein binder. Undiluted lemon juice or 28% acetic acid, sold as stop bath in photo stores, curdles the milk. A bath of clear ammonia (nonsudsy) from a grocery store or ammonium hydroxide diluted with water to a 1% strength helps clear a muddy print and also is one of the elements in the emulsion.

3. Pigments. Professional-grade watercolors or gouache in tubes work best. Liquid casein colors have been used with some success. Make sure that the pigment you use has no chromium (such as chrome yellow) in it, because this will react negatively with the bichromate.

4. Distilled water. Sometimes tap water is fine for making the bichromate solution, but the use of distilled water eliminates the frustration of possibly mixing bad solution.

5. Receiver. Finished prints should be produced on rag paper of medium absorbency for longevity, but practice prints can be made on less-expensive paper. All paper should be sized (page 79), and preshrunk, for more than one coating. James R. Collins, author of "The Gum Print" in *Darkroom Photography* (Oct. 1986), suggests the following method: Size the paper, then air dry it, apply the emulsion to an area about 1 in. (2.5 cm) larger on all sides than the image, and hang the paper in front of a cold-air fan to dry. When the emulsion is just barely tacky to the touch, put two pencil dots 12 in. (30.5 cm) apart and about ⅛ in. (5 mm) inside the emulsion edge. Hold a hair dryer about a foot (30.5 cm) from the paper, and evenly blow warm air over the paper until it has shrunk the paper by ⅛ in. (5 mm) and the pencil dots measure 11⅞ in. (30.25 cm) apart. Make the exposure, develop the image, and repeat this preshrinking (without resizing) procedure with each coating.

Preshrink synthetic or natural fabrics as described above. Practice making prints on paper first, because working on fabric is more difficult.

6. Sizing. Because sizing paper and fabric is necessary, messy, and time-consuming, you will find it more practical to size several pieces at once. The acrylic-polymer medium method (page 79) works well. It is easy, but it stiffens the paper and will not allow for shrinkage described in item 5 above. Todd Walker's alum sizing also is appropriate. See Chapter 4 for sizing formulae.

7. Ultraviolet light. You cannot see a color change with the emulsion, as you can in cyanotype or Van Dyke brown printing, so artificial lights such as sunlamps, photofloods, or fluorescents are recommended because the exposure can be exactly timed. However, indirect sunlight can be used; avoid direct sunlight, where bright radiant heat output can cause the emulsion to fog with exposures over 5 minutes.

8. Applicators. Try fine flat-bristle brushes or nylon paint brushes about 1 in. (2.5 cm) or more wide, a sponge brush, or a foam paint roller from the hardware store. A soft brush for coaxing the development of the print in water can be handy. Keep the metal part of the brush out of the bichromate solution. If you use an atomizer or air brush, be sure to wear a respirator, and work in a well-ventilated area.

9. Brown bottle. Since one of the emulsion's components, diluted ammonium dichromate, is light sensitive, it should be stored in a dark bottle, such as a clean, used fruit juice jar.

10. Cheese cloth and mesh food strainer. Inexpensive cheese cloth, purchased at a hardware or grocery store, is used to line a food strainer when cleaning the casein base. Do not use these materials to cook with later.

11. Printing frame. Use glass with Masonite, another sheet of glass, or foam core backing, or follow the instructions for building a frame on page 64.

12. Two trays or tubs. You will need glass or porcelain trays larger than the print when you develop the image and fix it.

13. Timer, watch, or clock.

14. Measuring spoons. Cooking utensils are fine. Small clear 4-oz. (102 ml) medicine measuring cups, available at pharmacies, are useful.

15. Measuring cup or beaker and stirring rod. You will need a cup or beaker that measures 16 oz (455 cc) in ½ oz (14 cc) increments.

16. Two registration pins, masking sheets, masking tape, ½ in. (1¼ cm) heavy black tape, ruler, hole punch, scissors, stencil knife (optional). If you are using more than one negative or more than one color, and you want the layers of the image to line up repeatedly, follow the instructions in Chapter 4.

17. Spray nozzle for sink hose and kitchen blender (optional). The spray helps with development while the blender makes the job of mixing the casein and the dichromate easier. Do not use the blender for preparing food afterward.

18. Protective gloves and respirator.

19. Shallow bowl. A small glass or china bowl or plate becomes the palette for mixing the emulsion.

20. Newspaper, hair dryer.

Tip for Making the Bichromate Solution

■ Should the crystals separate from the water, they will reblend when warmed to 90°F and stirred.

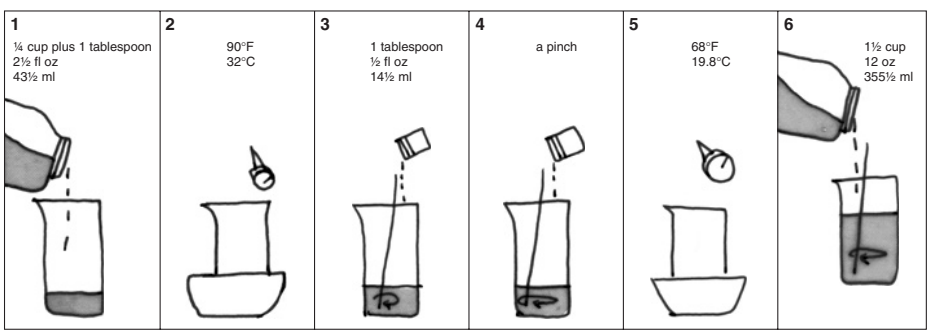
Making the Bichromate Solution

Equipment You Will Need

Ammonium bichromate crystals
Measuring cup or beaker
Bowl or tub
Stirring rod
1 oz (30 ml) measuring cup
Distilled water
Label
Brown bottle
Thermometer



Procedure



1. Pour water into measuring cup *to make* ¼ cup plus 1 tablespoon (43.5 ml, 2½ fl oz).

2. Adjust water temperature to 90°F (32°C).

3. With constant stirring, add 1 tablespoon (14.5 ml, ½ fl oz) bichromate crystals.

4. Add more bichromate until crystals will not mix in but precipitate to the bottom of the liquid.

5. Adjust water temperature to 68°F (20°C).

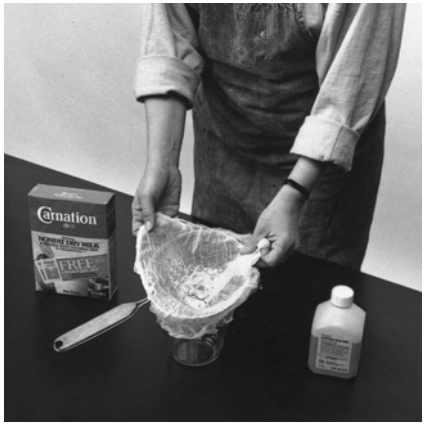
6. Stirring constantly, add water *to make* 1½ cups (355.5 ml, 12 oz).

7. Pour the bichromate solution into a labeled brown bottle.

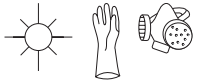
Tips for Making a Casein Print

- You must thoroughly mix the pigment with the casein and bichromate solution, or the emulsion will be streaked.
- Because the casein curd will dissolve three hours after adding the other chemicals to it, plan on doing multiple coatings during one print session.
- The pure casein can be refrigerated and preserved for a few days.
- Exposure times for casein printing must be determined by testing, so before you start on an actual print you can lower the frustration level by running the following test: Coat with emulsion and dry a sheet of 8 × 10 in. (20 × 25 cm) paper. Cut this sheet into 4 × 5 in. (10 × 12½ cm) strips, marking each strip to indicate the emulsion color and formula used. Using a different strip for each exposure, make tests of different lengths of time, being sure to note the exposure time and light source on the strip. Make sure the same part of the negative is used for each test. Develop, dry, and evaluate each test for each emulsion used, and keep a notebook with these tests strips for future reference.
- If the image is overexposed or the light source is too hot, the emulsion will harden and will not wash off. If the image is underexposed, the emulsion will float off, and if you use too much pigment when mixing the emulsion, the color will flake off.
- While the print is developing, you can lighten areas of it by rubbing very gently with a soft brush or cotton swab, but be careful because the emulsion is fragile and severe agitation can remove the image altogether.
- In the Jan./Feb. 2000 issue of *Photo Techniques*, Bob Whitfield describes "a new process: gelatin acrylic." He uses posterized high-contrast positives with semigloss house paint on paper sized with gelatin and coated with bichromate.

Making a Casein Print



1



Curdling the milk

In a measuring cup, mix 1 oz (30 ml) instant powdered milk with 7 oz (199 cc) hot water. By adding a few drops of 28% acetic acid or lemon juice to this mixture, curdle the milk.

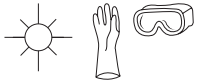
Arrange two layers of cheesecloth in a strainer, pour the curdled milk through it, catching the curd in the cheesecloth, and rinse the curd with cold water.

Squeeze the cheesecloth and curd.





2



Mixing the emulsion

Crumble the curd into a measuring cup, add 2 oz (50 cc) of 1% ammonia, and mix well by hand or electric blender. Thoroughly mix ½ teaspoon (2.5 ml) of the casein (or curd) mixture with ½ teaspoon of the dichromate solution and ¼ teaspoon (1.25 ml) watercolor pigment.

5

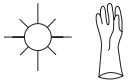


Developing the paper

The reaction that occurred during exposure continues after the emulsion has been removed from light. Therefore, immediately place the paper face down in a tray of cool water for 5 minutes. Move the print to a tray containing 2 oz (57 ml) of 1% ammonia and 32 oz (909 ml) cool water for 5 minutes. Development may take several dips back and forth; it is complete when the unexposed areas (highlights) of the emulsion dissolve and float off the paper, and the exposed areas (shadows, middle tones, and highlights with detail) are the same color as the pigment you used.



3



Coating the paper

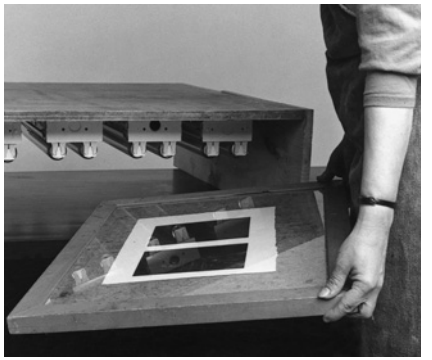
Use the emulsion to coat one 8 × 10 in. (20.25 × 25.5 cm) piece of paper by pouring it from the cup onto the sized paper and quickly working that emulsion on evenly with a brush to an area beyond the image. The emulsion will not look like the watercolor pigment at this point, but may have a yellow-orange tint to it.

6

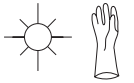


Fixing the print

Transfer the print to a final tray of gently running cool water for 15 minutes, remove the print, and air dry it flat or use a hair dryer. Resize the print if you want to add another layer of emulsion.



4



Exposing the print

Use a hair dryer on the cool or warm setting (based on the paper shrinking method, page 204), and when the emulsion is dry, make a sandwich with the backing board on bottom, paper with emulsion facing up next, negative reading correctly on the paper, and clean glass on top.

Place the loaded print frame in shade for 10–30 minutes, under a sunlamp or photoflood bulb 3 ft (1 m) away for 3–12 minutes, or under ultraviolet fluorescent bulbs 6 in. (15.25 cm) away for 6–15 minutes. Exposure times vary according to the light source, pigment color, and pigment density. You will have to experiment and keep notes.

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W. Snyder MacNeil, *Jazimina and Ronald*, from *Daughter/Father Series,* 18¼ × 23 in. palladium/platinum print on tracing vellum, 1987.
MacNeil captured an otherwise fleeting gesture by videotaping her husband and daughter, then playing the tape on a monitor, frame by frame, and selecting the image where she felt the energy between the subjects and the audience was strongest. She next photographed the frame with a conscious effort to incorporate the striations of the monitor's screen. An enlarged analog negative from that camera negative was made and printed. The image was exhibited hanging from a clothesline or sandwiched in two-sided Plexiglas™ mounted at a right angle to the wall, thus enabling the viewer to better sense the delicacy of the portrait.

Chapter 11

Platinum and Palladium Printing

- Materials 214
- Mixing the Stock Sensitizers 220
- Making a Platinum or Palladium Print 221
- Contrast Control Chart for Platinum/Palladium Printing 222

Historically considered the premier, treasured, hand-coated emulsion among photographers, platinum and the closely related palladium printing processes are two of the tonally richest and most permanent emulsions available. Depending on the paper and processing procedures used, the more expensive platinum can yield cool velvety blacks, while palladium renders warmer blacks and sepia browns. Although both processes are probably the most costly hand-coated techniques covered in this book, they can be combined with each other as well as with gum bichromate (Chapter 9), Cyanotypes (Chapter 7), and other techniques. The advantage of gum printing is that if you do not like what you created, you can remove it, whereas cyanotype is permanent.

My hero, Sir John Herschel, was the creative British scientist and gentleman who originated the formula for cyanotypes and figured out fixer for black-and-white photography and for Van Dyke brown prints. He announced publicly that platinum, when mixed with other chemicals, becomes sensitive to light. Forty years later, in 1873, William Willis refined, patented, and, in 1879, manufactured kits including precoated paper and requisite chemicals for the platinum printing process. He called his venture the Platinotype Company, but he later manufactured less expensive palladium kits. Within three years, devotees began coating their own paper when the formulae were made public. Other manufacturers, such as Ilford, (Agfa) Geveart, Ansco, and Kodak eventually entered the market. Because of the emulsions' stability and impressive permanence, relative ease to procure and use, and their sensuous results, at the turn of the century platinum and palladium were used by diverse and influential artists such as Frederick Evans, Alfred Steiglitz, Paul Strand, Edward Steichen, Gertrude Käsebier, and Francis Benjamin Johnston. When the cost of platinum increased during World War I (partly due to the discovery that this "noble metal" could be used to make explosives), platinum became so expensive that most manufacturers eventually stopped making platinum-coated papers, substituting palladium instead. Steiglitz wrote of his struggles to make palladium produce the kind of prints he wanted. "I do nothing according to instructions," and "If I follow them I might as well throw cans of paper into our blazing fire." He "made all sorts of experiments" with palladium paper, trying, as he told Strand, to determine its "elasticity." Often he made 100 attempts before he achieved even one that met his standards. He worked with different tones of paper, varied the temperature of developing baths, and explored the effects of wax and varnishes on the print.[1]

[1] Greenough, Sarah, et al. *Steiglitz in the Darkroom*. Washington, DC: National Gallery of Art, 1992.

Still, Laura Gilpin and Imogen Cunningham, among a group of platinum/palladium aficionados, coated their own papers and continued the tradition for decades. More recently, Irving Penn, Robert Mapplethorpe, and W. Snyder MacNeil (see the figure at the beginning of this chapter) have been part of the resurgence of platinum and palladium printers who have shown their work at prestigious galleries and used the processes in the commercial world.

Safety

Because of the health hazards and the number of chemicals used to make the solutions, I advise the use of premixed sensitizers as described later in this chapter. All chemicals should be clearly labeled and kept out of reach of children and pets.

Ferric oxalate (No. 1 and No. 2 solutions) is corrosive to skin, eyes, nose, and throat and causes severe damage internally—even death—if swallowed. So wear protective gloves and goggles. When mixing from the powder, use a respirator with toxic dust filter and protective goggles. If it should spill on your skin, wash immediately with soap or pHisoderm™ and water. Keep the top of the dropper bottles and the screw thread free of dried ferric oxalate by wiping them frequently with a damp paper towel.

Potassium chlorate (No. 2 solution) is added to increase contrast. Because it is moderately toxic upon skin contact, protective gloves should be used. If you are using the powder form to mix your own sensitizer, be aware that it is highly flammable and explosive. If it spills or is contaminated with impurities such as flammable or organic materials, it should be removed immediately with water. Care should be taken to avoid dropping, friction, and heat. Potassium chlorate should be stored away from heat and combustible materials, and a fume hood or acid gas respirator should be used to avoid the fumes, which are toxic.

When mixing from scratch, oxalic acid is sometimes used to make the emulsion more light-sensitive. It is extremely toxic upon skin contact, ingestion (it can be fatal if swallowed), and inhalation. Wear protective gloves, goggles, and an acid mask. In case of eye contact, flush with water for 15 minutes and seek medical attention. If swallowed, call your local poison center. Do not induce vomiting.

Palladium chloride (#3 palladium solution) is toxic upon skin contact and inhalation, so handle it with care and use a skin barrier cream. *Overexposure: Health Hazards in Photography* (see Shaw and Rossol in Annotated Bibliography) reports that palladium chloride causes cancer and reproductive changes in laboratory animals.

Platinum chloride (No. 3 platinum solution) is moderately toxic by skin contact and may cause allergic reactions. It is much more dangerous to breathe and can cause problems such as nasal irritation, asthma, or lung scarring and emphysema from repeated inhalation. Wear protective gloves and goggles when using platinum chloride and a respirator with toxic dust filter when mixing from powder.

Potassium oxalate is used in some formulas for developer. Because it prevents blood from clotting, it is highly toxic upon inhalation and ingestion. It is also corrosive to skin, eyes, nose, and throat, and can cause internal damage or death. I urge you to use ammonium citrate developer instead.

EDTA clearing agent is only slightly toxic, so handle it with care and use a barrier cream. Do not inhale the powder. I combine it with sodium sulfite, which is moderately toxic by inhalation and ingestion. Heating and treating sodium sulfite with acid causes the formation of highly toxic sulfur dioxide gas. Additionally, store it away from acids.

Some formulas call for hydrochloric acid in the clearing bath or in the developer. The concentrated form is highly toxic upon skin contact, inhalation, and ingestion. It should never be used near ammonia products and the gas from the acid is dangerous. Potassium dichromate, which can be added to hydrochloric acid to increase sensitivity, is moderately toxic upon skin contact and ingestion, but highly toxic upon inhalation. For these reasons, I recommend the use of EDTA or sodium sulfite instead.

Gold chloride solution can be added to palladium sensitizer, a few drops at a time, to warm the color or even turn it pink. It is moderately toxic, but wear gloves and a mask when repeatedly handling the powder because it can cause respiratory, kidney, and nervous system disorders.

Richard Sullivan and Carl Weese state in *The New Platinum Print* that platinum and palladium are a potential environmental hazard when you dispose of used developer. They assert these metals "may be removed by adding a small quantity of steel wool to the developer: about 1 pad per gallon of solution. Metallic iron will reduce out any noble metals into their pure state. After sitting overnight, there might be a small residue of platinum or palladium metal in the bottom. Pour off the developer and save the black metal in the bottom. The steel wool may also be shiny, which means it's been plated by the noble metals in the developer." Then dispose of it according to local regulations.

Method Overview

1. The emulsion is prepared by mixing together drops of sensitizer customized to work with your transparency.

2. Paper or fabric is sized and coated with the platinum or palladium salts sensitizer. It contains ferric oxalate, an iron salt.

3. An enlarged negative or object is placed on top of the coated surface. Light shines through the clearer parts of the negative or around the object, reducing the ferric oxalate to the ferrous state.

4. The exposed paper or fabric is developed. The ferrous oxalate dissolves and further reduces the platinum or palladium salts to dark pure metal in the exposed areas and a slight neutral tone in the highlights.

5. The paper or fabric is washed, then placed in three successive clearing baths to eliminate background tinge. It is washed again and dried.



Version I
Solution No. 1, 9 drops; No. 2, 13 drops;
No 3, 24 drops; 5-minute exposure.



Version II
Solution No. 1,18 drops; No. 2, 4 drops;
No. 3, 24 drops; 10-minute exposure.



Version III
Solution No. 1, 14 drops; No. 2, 8 drops;
No. 3, 24 drops; 12-minute exposure.

Jesseca Ferguson printed these three palladium images using one of her 8 × 10 in. pinhole negatives (Kodak Tri-X developed in Ektaflo diluted 1:15 for 2½ minutes). She used Bostick & Sullivan's premixed palladium chemistry, Crane's PS811 stationery, and an ultraviolet exposure unit (built according to the plans provided in this book, see page 67). The mixtures and exposure times are listed with each image. Notice how she has changed exposure times and adjusted the contrast via number of drops with each test print.

©Jesseca Ferguson, 1993–1994.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1. Image. You will need a negative transparency the same size as the positive print you wish to create. Both palladium and platinum emulsions render a seemingly limitless array of tones, so whatever is on the negative should appear in the print. In addition, the emulsions can be mixed to suit your negative and desired result, so there is great latitude in the appearance of the transparency.

However, many printers prefer dense negatives with a lot of separation in the shadow and midtone detail. Try overexposure and underdevelopment when making the ortho film positive before you

contact it to another sheet of film to make a negative (see Chapter 5, Making Negatives: Analogue Method). Once you make that positive you can make a more contrasty negative for platinum/palladium by using less dilute (e.g., Dektol 1:3) developer and make a different negative with low contrast (Dektol 1:9) for gum printing, if you are planning on combining processes. Or, try Polaroid black-and-white positive-negative film so that you overexpose the positive to achieve a dense negative.

If you use a view camera, try loading it with a panchromatic film, such as Ilford HP5, and overdeveloping by 15–30% in HC110, dilution B, or with Pyro Developer. These methods are not explained in detail in this book, so look in the Annotated Bibliography for one of the platinum printing books that does go into detail.

2. Chemicals. If I can acquire what I need already mixed without sacrificing quality, I do so because of the health hazards involved in mixing dry chemicals. I recommend you purchase either the Standard Platinum or the Standard Palladium Kit premixed from Bostick & Sullivan or from Photographer's Formulary (see Supply Sources) who send a catalogue and instructions. Although slightly more expensive than buying separate components, the kit is a good way to start and contains enough sensitizer to make sixty 4 × 5 in. (10 × 12.5 cm) prints. When you need to replenish, you can order specific premixed chemicals separately. Bostick & Sullivan also ships the Euro Kit for either technique because "it was not economical to airmail [United States] water to Finland—the Finns have their own." This kit contains premeasured, mostly dry chemicals to make sixty 4 × 5 in. prints. The Formulary will send dry chemicals, too. All Bostick & Sullivan kits contain ammonium citrate developer for cool tones and a bit higher contrast and EDTA clearing agent. Both Bostick & Sullivan and the Formulary sell potassium oxalate developer, which renders warm tones and sodium citrate developer for warmer tones and higher contrast. In the beginning, however, you may want to order a second bottle of developer so that you can "top off" (see item 15 below). The palladium kit is approximately one-half the price of the platinum kit. Since pure platinum is trickier to work with and higher in contrast, many printers combine palladium with some platinum sensitizer. I use 75% palladium and 25% platinum, but I know printers who use a 50/50 mixture.

You can mix 1 tablespoon sodium sulfite with 0.35 oz (10 g) oxalic acid and 36 oz (1 L) water for a clearing bath and even hypo clear (see page 93 "Clearing Agent") diluted as the manufacturer recommends. But the quickest clearing is accomplished in the bath I use: 1 tablespoon sodium sulfite, 1 tablespoon EDTA, and 1 quart (1 liter) of water.

Bostick & Sullivan sells a related process, Ziatype, which does not require a developer, and the color is controlled in the sensitizer. In addition, this "printing out" process allows you to watch the image form during the exposure, so that you can stop it when the print looks right.

Rockland makes a platinotype kit for medium- to high-contrast negatives and Artscraft will make a kit to your specifications. Be aware that ferric oxalate and potassium chlorate will go bad after 3–6 months at room temperature or with regular exposure to heat or ultraviolet light. The noble metals are stable.

3. Distilled water. If you are starting with dry chemicals, distilled water prevents mixing a bad batch of emulsion due to impurities in tap water. I also use distilled water to mix the clearing baths,

and many printers use it for the required washes. Dipping your coating brush in clean distilled water and blotting out the excess before spreading the emulsion helps to prevent the brush from taking up too much emulsion.

4. Receiver. If you are printing on paper—and I recommend that you do before you experiment with other surfaces—you will notice that the paper type dramatically affects the resultant image. Rag paper is more archival and works best with these permanent emulsions and tends to hold up when submerged in liquids for processing. Crane's Kid Finish, a good sheet to practice on, can be bought at stationery stores. It comes in cream (ecru) or white and in standard 8½ × 11 in. (21.5 × 28 cm) sheets of 25, 100, or 500 to a box. Bostick & Sullivan carries Crane's Kid Finish in larger sheet sizes, Crane's Platinotype (specifically sized for platinum), and Parchmont. Crane's manufactures with enough sizing that you will not have to prepare their papers, but you must handle the Kid Finish carefully in the clearing baths so that it will not rip. A method that seems to work well is to use nylon screening larger than the sheet of paper underneath the paper before you insert it in the first tray of liquid. With gloved hands you then can easily pick up the screening with the paper on top to move it from tray to tray. This method can be used with other delicate receivers, such as rice paper, calligraphy paper, and vellum. Or use the method on page 82 of Chapter 4, Creating the Photo-Printmaking Studio. One of the advantages of these surfaces is that you can easily coat the emulsion, dry it, and recoat and dry it (see Tips to this chapter) to ensure more detail in the final print. Vellum needs to be preshrunk, as explained in Chapter 4, because it tends to stretch when you coat it and will not lay down flat under the negative.

I like perusing art stores for smooth (because I prize detail) but absorbent rag papers, which tend to yield more sensuous tones than the Crane's paper mentioned above. Opaline Parchment, Arches and Fabriano 90 lb. hot press, Strathmore 400 drawing (for palladium only) or 500 Series Bristol, Berrger COT320, Rives Lightweight (for practice prints, because it is less expensive) and Heavyweight, Rives BFK, and Bienfang Rag Layout come highly recommended. All of these papers must be sized, as explained in item 6 below.

Arches manufactures Platine Paper, a 100% cotton, smooth, bright white, and heavy (310 g) paper that needs no extra sizing. In the United States, call Canson Talens at (800-628-9283) for product information and local distributors. Martin Axon, printer of Robert Mapplethorpe's platinum prints and owner of Platinum Press (see Supply Sources), tested this paper for Arches and also sells Platine in 30 × 44 in. (76.5 × 112 cm) and 22 × 30 in. (56 × 76.5 cm) sheets. In Europe, your art store can call Arches directly. This paper is fantastic if you are going to combine platinum or palladium together or with other processes because it holds up under repeated immersion in liquid. It is such a bright white that the image looks higher contrast, so I use the double coat method in the Tips (page 223) for more depth in the tones.

Fabrics need to be natural (see page 153 "Receiver" of Chapter 7, Cyanotypes, for more details). The original Platinotype Co. sold sensitized linen, sateen, and cotton. Using painters' canvas stretchers (as described in Chapter 7 on page 163) conserves chemistry and facilitates working on fabric.

In the original patent, William Willis claimed that he applied platinum emulsion by either one or more coatings to "paper, *wood,* and other suitable materials" (italics mine). The wood need not be sized unless it is quite absorbent, but prepared as described in Chapter 7 on page 153.

5. Ultraviolet light. Sunlight can be used, but due to variances in ultraviolet strength according to time of day and season, dependable results can be difficult to obtain. Artificial exposure sources, as described in Chapter 4, Creating the Photo-Printmaking Studio, are more consistent—or use a sunlamp centered above and covering the emulsion. Do not look at exposure lights without ultraviolet-protective goggles.

6. Sizing. Rag papers usually are made with sizing, but if you use less expensive paper, rice paper, or absorbent paper such as Rives BFK, you may want to size both for technical reasons (to prevent the paper from absorbing too much emulsion, thereby making even coating, reasonable exposures, and complete clearing difficult) and aesthetic reasons (different sizings affect the color of the emulsion differently). I recommend the arrowroot or starch methods for warmer results and the gelatin size for cooler hues. See page 80 for more details. Arrowroot sizing is not effective for multiple printings, however, such as gum over platinum or palladium.

7. Applicators. Polyfoam brushes 1 in. (2½ cm) or more wide work well, but tend to deteriorate after several uses. Care needs to be exercised when coating the emulsion on rag paper because too much pressure will abrade the paper. A modern imitation of the old-fashioned Blanchard Brush is described on page 81. My favorite applicator for showing the brush strokes in the finished print is the trusty Hake brush, available at good art stores. Its goat hair bristles are sewn to a wooden handle and need to be evenly cut to approximately ½ in. (1.25 cm) so that they do not soak up too much emulsion. Camel hair brushes with trimmed bristles are fine too. Platinum Press and Bostick & Sullivan sell a tube to lay down a smooth coating while saving chemistry. You can even use an atomizer to spray emulsion on the receiver if you lightly wipe the emulsion down with velvet afterward. Make sure that, whatever applicator you use, the emulsion does not come in contact with metal and it is not used for any other process. I moisten the brush in distilled water, blot it, then set it aside while I prepare the emulsion. The slightly damp brush helps to prevent picking up too much chemistry when I am ready to coat.

You probably will want paper towels to wipe the applicator and bottle (see Safety) as you work.

8. Printing frame. To ensure strict contact between negative or flat object and emulsion, and to avoid a blurry image, use a standard contact printing frame, plate glass with Masonite, another piece of glass, or foam core underneath. Make sure the glass is clean and dry before each use. Foreign particles lodged in the glass can create dimples in the paper. Or follow the instructions for building a frame on page 64. The structure needs to accommodate the dimensions of the paper, wood, or fabric. If you are using vegetation, such as flowers or leaves, place a sheet of plastic wrap from a grocery store or clear acetate from an art store above the emulsion. The heat from the exposure can cause the vegetation to "sweat," which causes stains. Dry and press vegetation for better contact and, therefore, better resolution.

9. Small brown glass bottles with medicine droppers. You will need to purchase and label three brown glass bottles and three droppers if you are mixing from scratch. If you are using premixed

solutions from Bostick & Sullivan or Photographer's Formulary, who ship sensitizers in clearly marked bottles, you will need only the droppers, available from them or a drugstore. The emulsion contrast is controlled by counting drops of each of the two ferric oxalate components and the noble metal solution. Do not use the same dropper for the different sensitizers. Eric Neilsen recommends adding 1 drop of hydrogen peroxide in a total of 20–30 drops of sensitizer if you need to increase contrast, but he advises never to use more than a very few drops, if any, or the hydrogen peroxide can pull platinum out of solution.

If you are mixing from powders, you will also need a plastic or glass 1 qt. (1 L) container for developer. Bostick & Sullivan ships their ammonium citrate developer as a liquid in a plastic bottle, but the Formulary sends you dry potassium oxalate for developer.

You can save leftover clearing baths in three properly labeled 1 qt. (1 L) plastic or glass milk bottles.

10. Five trays or tubs. They must be nonmetallic and larger than the print—one is for the first wash, three hold the clearing baths, and one is for the final wash water. If you use the sodium sulfite and EDTA recipe mentioned above (in item 2, Chemicals), you will probably need only one clearing tray, and if you use Hypo Clear, you will probably need only two trays. In addition, I use a Pyrex baking dish as both the developing tray and a first water wash tray because glass is easy to clean. You can also use a plastic photo tray, but do not use it for any other processes.

11. Siphon washer and safelight. The siphon, available on eBay, works well to wash prints when attached to a tray in a sink. Or you can drill small holes in the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains off. You can blot the print afterward with a clean, soft sponge or air dry it on a rack. A rack protected from light also is useful for allowing the emulsion to sink in after it is coated, as explained in the step-by-step instructions.

The emulsion needs to be coated and dried away from ultraviolet light, which is found in the exposure unit and in normal fluorescent room lights. Work only under safelights, weak tungsten light, or a 60-watt yellow "bug" light available at a hardware store. I use a tungsten bulb 4 feet (1.2 meters) away because it allows me to better see the color and the placement of the coating.

12. Sheet of glass or Plexiglas™ (optional). Hold the developed print at an angle on a sheet of glass while doing the first wash with a hose. This system allows unused chemicals to drain off, preventing them from contaminating the print. Wrap masking or duct tape around the edges to prevent the glass from cutting you and to cushion it from breaking.

You may want to tape your substrate onto another sheet of Plexiglas™ or a coating board while you apply the emulsion.

13. White bowl or saucer. I use white ceramic (never metal) for mixing the sensitizer drops because they are easier to see on white surfaces under subdued light. Some printers use a shot (jigger) glass or egg cup. When I used glass, I placed it on white paper so that the drops were visible.

14. 32 oz (1 L) beakers or measuring cups and tablespoon. You will need a container of distilled water for holding and rinsing out the coating brush, but make sure you remove excess water from

the bristles before coating each print. A large beaker of hot water, a crock pot, or a hot plate come in handy for heating up the developer beaker to 120°F (49°C) for warmer tones in a palladium print and for warming the bottle of No. 3 platinum and palladium sensitizer, which has a tendency to precipitate out of solution. Glass beakers conduct heat more rapidly than plastic. If you are mixing your own solutions, you will need measuring utensils and a gram scale. Again, do not use metal.

A tablespoon is used for measuring the EDTA powder for the clearing baths.

15. Funnel, tongs. Use a glass or plastic funnel to save prepared liquids or when mixing stock solutions from dry chemicals. Use tongs or wear heavy gloves to move prints in the clearing baths.

I "top off" the developer, which is a method for enriching the developer with the noble metals. After a print is in the wash, I use a funnel to pour back the leftover developer into the bottle. Then, using a fresh solution of developer, I add enough more to reach the top of the bottle.

16. Newspaper or cardboard. Cover the coating area with newspaper or coat on corrugated cardboard into which you pushpin the paper.

17. Humidifier (optional) and heater. The coated paper can be humidified before it is used. You can build a humidifying box in which you place a fan and small humidifier set for 60% relative humidity. Jesseca Ferguson, who created the illustrations at the beginning of this chapter, always keeps her whole studio at 50–60% relative humidity, which she checks with a wall-mounted digital meter. Especially in cold weather when the air can dry out, adding humidity can help with the coating procedure. You may need to run the humidifier for an hour for Ziatype. Platinum, palladium, and ziatype are sensitive to cold, which can cause graining. Heat up the room to 75°F (23.9°C).

18. Protective gloves, mask, and apron. Wear heavy neoprene gloves while you work, a respirator for mixing powders, and an apron to protect your clothes from contamination.

19. Hair dryer and/or clothesline and pins. Use a hair dryer on the cool setting or a fan to thoroughly dry the emulsion before laying a negative on top. A clothesline and pins or a rack can be used to dry finished prints. Please note that in item 11, a drying rack protected from light is recommended.

20. Pencil, low tack tape. It may be easier to tape or tack the receiver to a table or board and draw an outline of your negative on it to facilitate coating the emulsion. Make a cardboard template, or use the cardboard package with which the film was boxed so that you do not accidentally damage the negative. In addition, I pencil notes about the number of drops, amount of exposure, and type of paper on the back of the print.

21. Typing paper and gram scale (optional). If you are weighing raw chemicals, they should not come in contact with metal or other contaminants. Avoid this problem by placing a sheet of lightweight paper on your scale.

Mixing the Stock Sensitizers



This recipe is included if you really must mix from scratch, but I truly advise that you skip this procedure and order the three premixed sensitizers for the sake of your health and safety. Use a gram scale and be exact.

Sensitizer No. 1 (Low Contrast)

Mix together:

- 1½ oz (50 cc) distilled water at 100°F (38°C)
- 0.04 oz (1 g) oxalic acid (optional)
- ½ oz (13 g) ferric oxalate

Use at room temperature.

Sensitizer No. 2 (High Contrast)

Mix together:

- 1½ oz (50 cc) distilled water at 100°F (38°C)
- 0.04 oz (1 g) oxalic acid (optional)
- ½ oz (13 g) ferric oxalate
- 0.02 oz (0.6 g) potassium chlorate for platinum *or*
- 0.01 oz (0.3 g) potassium chlorate for palladium

Use at room temperature.

Sensitizer No. 3 (Metal)

For platinum, mix together:

- 2 oz (80 cc) distilled water at 100°F (38°C)
- 0.7 oz (20 g) potassium chlorplatinite: crush it with a plastic spoon, then pour it into the water slowly while stirring.

For palladium, mix together:

- 2 oz (80 cc) distilled water at 100°F (38°C)
- 0.3 oz (8 g) palladium chloride: crush it with a plastic spoon, then pour it into the water slowly while stirring.
- 0.2 oz (6 grams) sodium chloride.

Sensitizer No. 4 (optional)

- 1–2% gold chloride, a few drops to warm the tones and reduce the contrast of a platinum print or to tint a palladium print toward lavender. If you want only to change the tones and not reduce the contrast, add more drops of high-contrast (No. 2) and less low-contrast (No. 1) sensitizer. If gold chloride is used, do not replenish the developer as suggested in the Tips below.

Developer

Mix together:

- 1 lb. (453.5 g) potassium oxalate
- 48 oz (1.5 l) distilled water at 120°F (49°C)

After you mix the solutions, shake them in their individual bottles to further blend them. Keep the platinum and palladium bottles warmed to make sure that the metal is in solution. The shelf life of #1 and #2 is approximately 3–6 months in a tightly stoppered brown bottle. The metal sensitizers and oxalate developer will last indefinitely in a tightly stoppered brown bottle.

Making a Platinum or Palladium Print



1

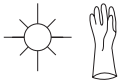


Preparing the chemicals

Set up three trays in a sink and mix 1 tablespoon (14 cc) EDTA and 1 tablespoon sodium sulfite to 1 qt (1 L) distilled water in each. You may find that the powder dissolves more easily in warm water, but use the baths at room temperature. Start to warm the No. 3 sensitizer bottle in a cup of 90°F (32°C) water to dissolve the crystals, but use it at room temperature. Some printers warm the developer at this point, too.



2

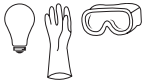


Preparing the paper

Secure your paper to the coating board. Using a hard (e.g., 2H) pencil, lightly outline the image area. Leave a little extra paper for a test strip and for handling.



3



Preparing the emulsion

Referring to the chart on page 222, drip the appropriate number of drops of each solution and distilled water into your cup. Watch for crystalline deposits in the No. 3 sensitizer, which you may have to heat up again.



4



Coating the paper

Thoroughly swish the solution together, then puddle it in the middle of the image area. With a slightly predampened brush, quickly and evenly spread the emulsion in one direction, then flip the brush and go back in the opposite direction after each stroke. Next, lightly brush at a 90° angle until the emulsion dulls. Do not worry about streaks. With the remaining emulsion on the brush, coat a swatch for a test strip.



5



Drying the paper

While the paper is on the coating board, allow it to sit in the dark for 3–5 minutes as the emulsion settles in and partially dries. Then apply a second layer of emulsion. Wear a respirator with a toxic dust filter while using a hair dryer on the cool setting to finish drying both sides of the paper after it has been removed from the coating board.



6

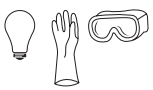


Exposing the print

Place the paper, coated side up, on a backing board and position the negative, correct-reading side on the emulsion. Lay this unit under heavy glass. Place the loaded print frame in direct summer sunlight for 1–5 minutes or under artificial ultraviolet light for approximately 5–25 minutes, or until the highlights have detail tone. Different papers and types of negatives will affect the time.

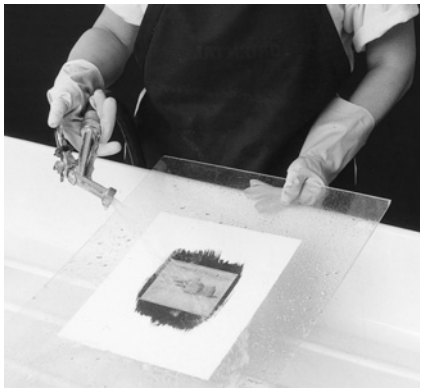


7

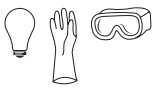


Developing the print

Remove the paper and place it in the developing tray held at a slight angle. Quickly and evenly, pour developer over the exposed print and swish it around for a few minutes. Or quickly immerse the print completely in a tray of developer, then rock the tray.



8



Clearing the print

Place the paper on a piece of Plexiglas™ angled in a sink. Gently hose the paper with water then rock it in a tray of running or changing water for 1 minute. Next, gently agitate the paper in three successive clearing baths for 5 minutes each. When the first bath becomes discolored from use, after approximately three 8 × 10 in. (20 × 25.5 cm) prints, discard it. Move the second tray to the first position, the third tray to the second position, and mix fresh clearing agent for the third bath.

9



Washing the print

Drain the print, then use the siphon or tub method to wash it for 20 minutes. Blot excess water from the print with a clean, soft sponge and air dry on a rack, hang from a clothesline, or use a hair dryer or fan. Prints dry down considerably darker.

Contrast Control Chart for Platinum/Palladium Printing

Negative Contrast	Black-and-White Filter Comparison	Solution 1 (Number of drops)	Solution 2 (Number of drops)	Solution 3 (Number of drops) and equal number of drops of water		Emulsion Description
				No. 3	Water	
Very high	N/A	24	0	24	24	Very soft
Quite high	N/A	20	2	24	24	Quite soft
High	0	18	4	24	24	Quite soft
Contrasty	1	15	7	24	24	Soft
Normal	2	12	10	24	24	Normal
About normal	2½	9	13	24	24	Normal
Somewhat flat	3	6	16	24	24	Hard
Quite flat	4	4	18	24	24	Quite hard
Very flat	5	2	20	24	24	Very hard
Extremely flat	N/A	0	24	24	24	For extreme contrast

All drops are calculated for double coating an 11 × 14 in. (27.9 × 35.6 cm) print. Increase drops by approximately 1.5 for 16 × 20 in. (40 × 51 cm) image or decrease for 8 × 10 in. (20 × 25.5 cm) image.

Tips

■ In order to cut back on the cost of a platinum print and to warm its tones and reduce contrast, palladium sensitizer can be added when mixing the emulsion. The ratio I use is 25% platinum and 75% palladium, but just remember that the total number of drops of the No. 3 sensitizers, which contain the actual metals, should nearly equal the sum of the number of No. 1 and No. 2 drops used. In addition, the number of drops of water should be the same as the No. 3 mixture. This formula also reduces solarization—the reversal of tones—sometimes seen with pure palladium.

■ Two thin coatings yield richer dark tones and allow you to make up for an uneven first layer. Some printers do not add water and apply one coat only. In addition, you can coat a sturdy substrate, expose a negative, process, dry a print, then recoat and re-expose with a different negative, process, and dry.

■ The drying procedure is important because the sensitizer needs to soak into the paper, but too long a drying time allows the sensitizer to sink too far in, yielding a flat image.

■ You may find that the same negative prints differently from session to session. Variances in the chemicals used by the paper manufacturer, not the platinum/palladium emulsion, may be the culprit. Try printing on an entirely different paper and see if the same problems in print appearance arise. Sizing the paper may help, too, because it will provide a more uniform surface. Photographers Formulary recommends arrow root (see page 80).

■ Liquid ferric oxalate in the No. 1 and No. 2 sensitizer can go bad and cause black specks in the coating.

■ In order to help protect the emulsion from the coating brush's ferrule you can cover the metal parts with clear nail polish.

■ If you notice areas of uneven darkness in the finished print, the emulsion might have pooled during coating. Next time, do not allow sensitizer to sit too long in one spot before brushing.

■ For suggestions on coating fabric, refer to the Cyanotype on Fabric section at the end of Chapter 7.

■ Heated developer warms the tones in a finished print and keeps the constituent chemicals from precipitating out, but it also reduces image contrast. Therefore, to boost the contrast, add more No. 2 solution when mixing the emulsion and increase the exposure time (No. 2 also decreases the light-sensitivity of the emulsion) or add one drop of hydrogen peroxide. Hot developer works more quickly. Make sure the test print and the final print are developed at the same temperature.

■ Some printers save used developer, claiming that as it ages it becomes "richer." They pour the developer back every time it collects in the developer tray, replenishing the bottle with fresh developer, as described in item 15 above. "Topping off" is not recommended if you are using gold

Tips *(cont.)*

chloride or solely EDTA as the clearing agent. In addition, EDTA is recommended only with slightly acidic developers, such as ammonium citrate, but may not be effective with other developers.

- Old developer makes a fine home for slimy mold. I have filtered the mold off and continued to use the developer, but the safest solution is to buy fresh developer.

- If you are making a pure platinum print, do not use the same replenished developer you used for palladium, and vice versa.

- Wash the brush out thoroughly between each coating. Emulsion left on the bristles can become exposed and contaminate succeeding prints. To avoid soaking up too much emulsion, dry the brush until it is slightly damp.

- Splotchy and mottled stains in the finished, dried print can indicate where the emulsion was not thoroughly dry before exposure. Wet emulsion can also ruin your negative. Grainy or mottled highlights can be caused by too much humidity (over 70%). Drying the *back* of the coated paper on the hot setting of a hair dryer can help reduce the problem, but the temperature should not be above 120°F (49°C) or you may create dark spots in the final print. Condensation from the heat of the hair dryer meeting a cold coating surface can also cause mottling. Storing unexposed, coated paper with silica gel desiccant (I recycle the gel that comes with vitamin pills) in an air- and light-tight container is advised.

- Exposures will vary according to the negative density, with very dense ones taking over a half hour. Keep a notebook of each print, its sizing and paper, age of the chemicals, what mixture you used, and exposure time. Then when you have a similar negative, you will know where to start. Exposures also will be longer when you use citrate, rather than oxalate developer, but I usually start my tests at 6 minutes.

- Streaks in the print, running through shadows, midtones, and highlights may be caused by uneven development and may be particularly prevalent with hot developer. Try to develop the whole print promptly and uniformly next time.

- Yellow highlights indicate insufficient clearing time or weak/exhausted clearing bath. Either increase clearing time, the concentration of EDTA, or mix fresh baths.

- You can clear a print after it dries, if it has been kept out of light.

- Fogged (grayed) highlights can be caused from ambient fluorescent or ultraviolet light.

- Flat, undifferentiated shadow detail can be caused by four reasons. The first is a negative that does not have any density in the shadows. If the negative is not so thin that there is no separation in the shadows, you can mix up a more contrasty emulsion and try exposing it again. Another reason could be that the paper is not sized properly, which can increase developing time and prevent thorough clearing, too. Paper and sizing are the crucial factors after negative density and emulsion contrast.

- I make test prints before I create a final print. Cut a strip of paper one-third the size of your negative. Coat it with emulsion, dry it properly, then place a part of your negative with shadow detail, highlight detail, and midtones over the strip. Place the unit under glass, but cover two-thirds of it with opaque cardboard. Expose for 5 minutes. Move the cardboard and expose for another 5 minutes. Process the test strip normally, dry it, then, under a good viewing light, choose a proper exposure for the finished print.

- Prints dry darker, and so they look different when wet than when dry.



Gene Laughter, *Flight,* 9 × 12 in. (23 × 30 cm), bromoil print, 1997.
A seagull in flight was rendered with five lithographic ink colors layered one on top of another. To simulate motion, steel wool was used to induce streaks in the pigment. Coffee was flicked onto the surface from the artist's fingers to create small spots. This bromoil print departs from the traditional methods and images usually associated with the bromoil process, as Laughter often blends historical technique with more contemporary pictures, and his method of ink application borders on painting. He has produced a video, "Bromoil 101" that he sells through Bostick & Sullivan (see Supply Sources). http://members1.clubphotos.com/gene46746
Gene Laughter, a retired advertising executive, owns a fine-art photography studio and gallery, The Bromoil Factory, in Richmond, Virginia. Winner of awards for his artwork, Laughter is the author of *Bromoil 101* (see Annotated Bibliography), founder and past president of the Photographic Art Network of Virginia, and a member of the Bromoil Circle of Great Britain. He has given many talks and workshops on bromoil and is founder of the International Society of Bromoilists. You can contact him at his e-mail address: glaughter@ earthlink.net.

Chapter 12

Bromoil Printing

Gene Laughter

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Bromoil is a photographic control process introduced by C. Welborne Piper in 1907, based on the theories of E. J. Wall. Bromoil was popular among the pictorial photographic salon exhibitors in the first half of the twentieth century. The process gradually lost favor following World War II, as supplies dwindled and as pictorialism gave way to the less romantic and more representational styles of photography.

Safety

Pigment powders pose little immediate damage from ingestion or inhalation, but repeated exposure to small amounts of some pigments can cause chronic poisoning or other serious effects. To check on the effects of individual colors, read Shaw and Rossol's *Overexposure: Health Hazards in Photography*, listed in the Annotated Bibliography.

Copper sulfate may cause skin allergies and irritation. Chronic ingestion can cause anemia. Wear a toxic dust mask and gloves.

Potassium bromide in large amounts can cause mental problems and skin rashes. Wear a toxic dust mask and gloves.

Potassium bichromate (also known as dichromate) is highly toxic by inhalation and is a suspected carcinogen. Skin contact may cause irritations and allergies. Wear gloves, goggles, and a toxic dust mask.

For safety guidelines regarding black-and white photo chemicals, see Chapter 5, Making Negatives: Analogue Method.

Naphtha can be highly irritating to the skin and eyes and is flammable. Wear gloves, make sure you have proper ventilation, and store naphtha away from open flames and lit cigarettes.

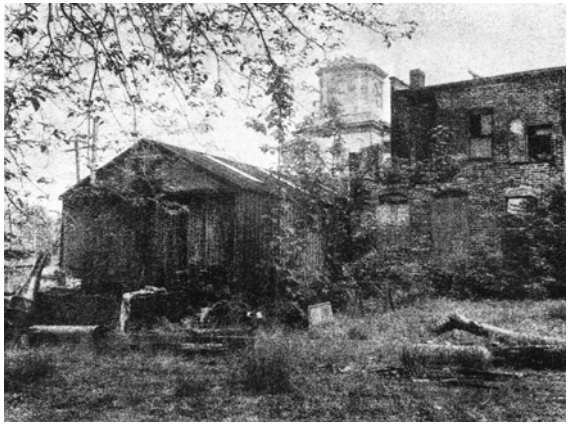
Method Overview

1. A low-contrast black-and-white photograph is made.

2. The photograph is bleached, tanned, and dried.

3. The original silver image is replaced by applying an oily pigment, such as lithographer's ink. The resultant print can be detailed or impressionistic, grainy or smooth.

Materials



A bromoil print rendered in a photographic manner, which employed the use of both a brush and brayer for inking. The silver in the original photograph has been replaced by pigment, resulting in an archival print.



Decorator's foam painting rollers, shaving brushes, cosmetic brushes, artists' brushes, basting and pastry brushes, and faux-finishing brushes may be used for applying ink to a bromoil matrix.

1. Brushes, scissors, and foam rollers. You can quickly and easily make your own brushes by modifying Williams-Sonoma pastry brushes, faux-finishing brushes, hog bristle shaving brushes, sash brushes, or artists' brushes. Using sharp scissors or barber's shears, simply trim the bristles at a 25–30° angle. Use VMP naphtha for cleaning tiles and brushes (see Care of Bromoil Brushes, later in this chapter). Newspaper also is helpful for cleaning the brushes.

A small 4 in. (10 cm) decorator's foam paint roller purchased at a building supply store may be used for applying and evening out ink and for clearing highlights. The roller also can be used in combination with a brush.

2. Ink. Graphic Chemical and Ink Co. No. 1803 crayon black is the most popular ink used by bromoilists. No. 1903 dark brown may also be used, as well as any number of other colors. Each bromoilist may best determine whether to use only black or brown or to add additional colors. Van Son Rubber Base Plus V5151 black printer ink is also very good and is available in many colors at commercial printing supply companies.

Most lithographic inks come in a can, which should be tightly sealed after taking out the small amount to be used for a bromoil session. Take the ink from the can with an artist's spatula by scraping lightly with the blade. Do not gouge into the ink and form holes, which can dry out the contents. Use plastic (electric) tape to seal the lid.

3. Ink modifiers. To stiffen the ink, add a drop of melted candle wax or beeswax, artist's dry pigment from an art store, or magnesium carbonate from a litho supplier. To soften the ink, add a pinhead-size drop of plate oil or linseed oil purchased at an art supply store. A small drop of Canada balsam (see Art Craft Chemistry in the Supply Sources) may be added for more tackiness.

4. Inking tiles and palette knife. Purchase several smooth, white, ceramic bathroom-type wall or floor tiles in sizes from 4 in. (10 cm) to 12 in. (30.5 cm) square. Spread the ink on the tile with a palette knife, which can be found with oil painting supplies in an art store.

5. Small rubber brayer. Use a 1½ in. (4 cm) or 2 in. (5 cm) brayer for spreading the ink on the tile in a thin, perfectly smooth layer.

6. Inking support. A piece of beveled plate glass several inches larger than the print makes a perfect support for inking. The support may be tilted to your liking.

7. Photo blotter. Place the blotter on the inking support when drying the front and back surfaces of the bleached print (the matrix). Remove the blotter from the support before you begin inking.

8. Soft paper towels or flannel. Use a paper towel folded in quarters for a smooth pad with a flat surface to blot the surface water from the front and back of the matrix.

9. Cosmetic wedge, cotton balls, cotton swabs, or plastic wrap. All of these items can be used to clean a bromoil print.

10. Steel wool. Artists' grade extra-fine steel wool can be used to create texture in the final print.

11. Bleaching and tanning chemicals. Bromoil bleaching kits are available from Art Craft Chemistry or Bostick & Sullivan (see Supply Sources). These kits have premeasured amounts of the requisite dry chemicals, which are added to distilled water to make 1 qt (0.95 L) each of the three



Bromoil bleaching kits make the preparation of the stock solutions simple. No weighing scales are necessary. Wear gloves, goggles, and a toxic dust mask while you pour the contents of each of the three bags into separate 1 qt (0.95 L) bottles and add distilled water to the top of each. Shake vigorously.

stock solutions. You will need three brown bottles for storage. Measure and mix working solutions just prior to bleaching and tanning.

12. Hand-coloring materials. Dry bromoil prints can be enhanced with colored pencils, pastels, Peerless Water Colors, food coloring, and coffee.

13. Photographic paper. Recently photographic papers have been in a state of flux as many papers have been discontinued and Agfa Photo went out of business. For the bromoil process most semimatte fiber-based papers will work. Generally, semimatte papers ink up better and far easier than glossy or dead matte ones. You may have read that only non supercoated papers will ink properly for bromoil. This was true many years ago, but not now. Many bromoilists, including the author, actually prefer super-coated papers for bromoil. You may need to experiment with the paper a bit in order to come up with the proper amount of exposure during enlargement and the time and temperature of the soak water. Also, several brands of non supercoated papers produced specifically for bromoil are available in the United States and Europe. David Lewis (see Supply Sources) makes special Bromoil paper.

14. Darkroom and black-and-white photo chemicals. Instead of conventional fixer, use a 10% solution of pure hyosulfate, available from Art Craft Chemicals, Photographer's Formulary, or Bostick & Sullivan, all listed in Supply Sources. The simple way to make up a 10% solution is to pour the hypo crystals in a beaker to the 4 oz (118 ml) mark and add this amount to 1 qt (0.95 L) of water. Or, you can use liquid Kodak Rapid Fixer diluted as the manufacturer recommends for paper, but without the hardening solution. (See Chapter 5, in which orthochromatic film is handled in a similar way to photographic paper.)

15. Labeled trays. You will need separate trays for bleaching/tanning and the first soak, and either a tray with a siphon or an archival print washer.

16. Acetate, tape, pencil. Acetate sheets, available from an art store, or old sheets or ortho film are cut with a straight edge and stencil knife. The 2–3 in. (5–7.5 cm) wide strips should be 3 in. (7.5 cm) larger than the image and taped together at a 90° angle to each other to form an "L" if you plan on darkening edges and corners of the print. KleenEdge or low-tack tape, sold in some building supply stores, is especially easy to use for this purpose. A pencil is helpful for keeping notes on the back of the print.

Guidelines for Bromoil Printing

Bromoil is a marriage of photography, printmaking, and painting. The printing and processing of the matrix are fairly inflexible procedures. A standard routine should be established and followed. After the matrix is prepared and is ready for inking, however, bromoil becomes a more freewheeling process with great latitude. One cannot properly direct another on how a bromoil print should look. It is an individual, creative process. The tips in this and the following sections will help you get started, however.

Making a Bromoil Print

1



Selecting the image

Selecting any black-and-white negative that fits your enlarger system. The negative size is not important. The best type of negative for bromoil should not be contrasty but should possess a full range of midtones and detail in both shadow and highlight areas.



2



Making a test print

In a conventional darkroom, make a test strip or a test print on fiber photographic paper to determine the best normal exposure and the optimum times for burning and dodging. This print is useful as a guide when inking the matrix to determine the tonal values and details you wish to bring out in the inking.

3



Make a guide print and process it at the exposure determined in step 2.



4



Exposing the print

Make a print for bromoil by opening up 1 stop more than the exposure for the guide print if you are using super-coated paper (United States) or ¼ stop more if you are using nonsuper-coated paper (United Kingdom and Europe). Super coating is a hardened antiabrasive layer the manufacturer uses. Leave a safe edge, or white border, of at least 1 in. (2.5 cm) around the bromoil image for ease of handling later.

The print in the above photograph was exposed a full stop more than the test print. The overprinting allows the gelatin of the super-coated paper to swell sufficiently later in the bromoil process.

5



Developing the print

Fully develop the print for 3 minutes in either Ethol LPD, Kodak Dektol 1:9, or Rodinal (Photographer's Formulary, In Supply Sources, makes the equivalent) film developer 1:30. Agitate continuously. Place the print in stop bath for 45 seconds or water bath for 5 minutes, and then fix the print in a bath of 10% solution of sodium hypothiosulfate or liquid Kodak Rapid Fix *without* the hardener added.

6



Washing, drying, and soaking the print

Wash for at least 30 minutes with a siphon washer in a tray or in an archival print washer. Gently blot off any surface water. Air dry for at least 6 hours. Super dry by holding a hair dryer on the hot setting 4 in. (10 cm) above the print until it is crisply dried. Completely soak the print for 5 minutes in a tray of water at room temperature. Drain it.



7



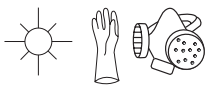
Bleaching the print

Mix a tray of bleaching/tanning solution at working strength from 2⅛ oz (70 cc) of 10% copper sulfate stock solution, 2⅛ oz (70 cc) of 10% potassium bromide stock solution, and 1 oz (30 cc) potassium bichromate stock solution. Add enough distilled water to this mixture to make 1 qt (0.95 L), which will bleach/tan approximately eight to ten prints with an image size of 6 × 8 in. (15 × 20 cm).

Constantly agitate no more than three or four prints at a time while bleaching them for 8–10 minutes. Use tongs and gloves.



8



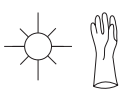
Washing and fixing the matrices

Wash these bleached prints, called *matrices,* for 10 minutes to remove traces of the bichromate.

Fix in a fresh bath of 10% solution or Rapid Fix without hardener for 5 minutes. Wash in running water at room temperature for at least 30 minutes. Gently blot off water. Air dry for at least 6 hours. Super dry (step 6) again.

On many papers a faint latent image may be seen. Sometimes, one can see a greenish tan image. If there should be dark brown or black areas, however, you might have exhausted the bleach solution or printed too dark a photograph.

9



Preparing the ink

Place a pea-size dollop of lithographic ink on one corner of the inking tile and spread it into a thin layer with the edge of a palette knife, as if you were spreading butter on toast. Using the brayer, spread out the ink into a perfectly smooth square patch on the tile. If you will be applying ink with a brush, roll the ink into a 2 in. (5 cm) square. If you will be applying ink with a roller, the square should be 1 in. (2.5 cm) or so larger than the roller.

10

Preparing the matrix for inking

Soak the matrix in a tray of tap water at 68–75°F (20–24°C) for 10–20 minutes. The actual time and temperature of the soak can vary with the degree of hardness of local water and with the photographic paper used for making the matrix. Soak only one matrix at a time, and keep it totally submerged by placing coins or pebbles on the safe edges.



11

Blotting the matrix

Place the matrix on blotting paper and remove every visible trace of surface water from both sides using a folded soft paper towel. Dry the back of the matrix by gently rubbing, and blot dry all traces of water from the emulsion side of the bleached matrix.



12

Inking and resoaking the matrix

Move the matrix, emulsion side up, to a plate glass support angled as needed for your comfort. Apply lithographic ink of the desired stiffness (see the following Tips). The wrist is used as a fulcrum when inking. See the following section Brush Actions for Inking for detailed information on inking techniques.

Evaporation diminishes the differential swelling of the gelatin so that highlights readily and uniformly accept ink, making proper inking increasingly difficult. You may also notice the corners of the matrix beginning to curl slightly. Resoak the partially inked matrix for a few minutes in room-temperature water. During the resoak, reroll the ink on your tile with a brayer to even the ink. Blot the matrix dry again. Continue inking and resoaking until the bromoil print is complete.

Tips

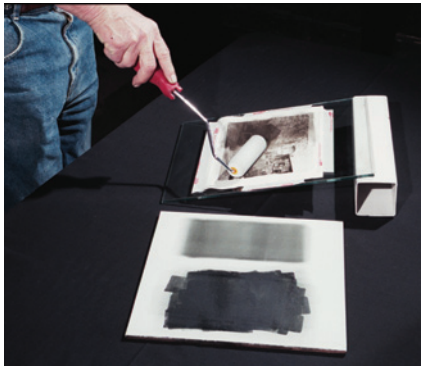
- The best way to establish the time needed for the soak prior to inking (see step 12) is to cut a matrix into quarters and experiment with inking it after soaking one piece for 10 minutes, another for 15 minutes, a third for 20 minutes, and a fourth piece for 25 minutes. With this test procedure, one can establish the proper lengths of future soaks. Write the information on the back of the print.

- Immediately preceding a resoak of the matrix (see step 12), remove any broken hairs or tiny bits of debris on the surface of the print with the pointed end of a kneadable eraser. Form a piece of plastic wrap into a ball and dab any ink blobs or overly inked areas while constantly turning the ball so that a fresh, clean area is always touching the print's surface.

- Ink may be applied to the matrix either with a brayer, a brush, or a combination of brush and roller. Roller inking is much faster and easier than brush inking and imparts a more photographic, contrasty appearance to the print. The roller action eliminates all grain and softness. Brush inking renders a print with more grain. Many contemporary bromoilists combine the two by first applying a fast, even layer of ink onto the matrix with a brayer, then using the brush for the balance of the inking. Others use a brush for ink application and a roller for evening out the ink and for clearing the highlights.

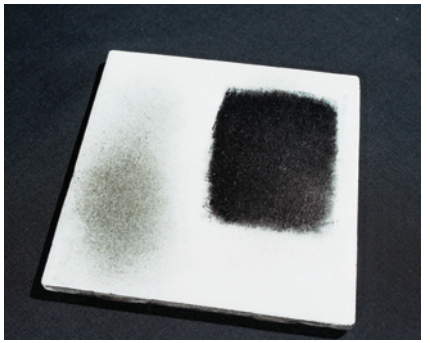
- When using a brayer for inking, tape the matrix to the glass with KleenEdge or low-tack masking tape so that the print will not curl around the brayer's roller. Slow rolling with downward pressure applies the ink, whereas rapid rolling with almost no pressure clears the ink and brings in fine detail. Turn the matrix and repeat the procedure with horizontal rolls. Do not be concerned with overall

streaks. Return the matrix to its vertical position. Clear the brayer by rolling it onto a clean portion of a large tile until the ink is removed. Then rapidly and lightly use the brayer on the print to roll in all directions. This action clears the print and evens out the ink.



Use a 12 in. (30.5 cm) tile or two smaller tiles when inking with a roller. The darker patch of ink on the tile has been completely smoothed out with a brayer, and the lighter patch is the clearing area. Clear the roller by rapidly rolling on the light area before applying ink to the matrix. This procedure evens out the ink on the roller and allows you to apply a series of very thin ink applications. Do not try to apply too much ink at one time.

■ When applying ink with a brush, rapidly and lightly tap the tip of the brush on the tile's smoothed-out ink patch, then tap the brush several times on a clear portion of the tile to even out the ink on the bristles. This second spot is the area you will work from when you place ink on the brush prior to inking the matrix. The first smoothed-out square is your ink reservoir.



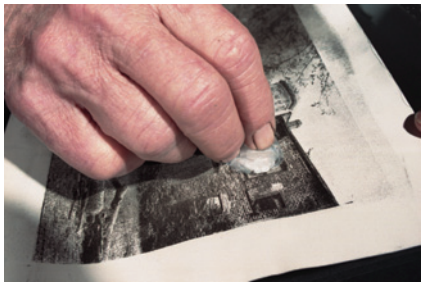
The light, perfectly smooth patch on the left is the one from which you will get your ink. Do not go directly from the ink reservoir patch to the print or the brush will have too much ink unevenly distributed in the bristles.

■ You can use a foam roller to clear a brush-inked print, to bring out detail, and to even out any overinking. First, use low-tack masking tape to adhere the matrix to the inking support. With a rapid, extremely light touch, roll the foam roller across the print. If you want to bring back grain after a foam roller clearing, re-ink the print with a minimum of brushwork.



Clearing: Ink has been applied to the left half of this matrix by slow forceful rolling with a foam roller. The right half has been cleared by rapidly rolling with a foam roller and no pressure.

■ In the latter stages of the inking process, a wet foam paintbrush or wet cosmetic wedge can be lightly rubbed onto the highlights to make them more brilliant and to increase the overall contrast of the bromoil. Do not apply any pressure; just let the weight of the wet wedge or brush do the work. A soaking-wet, soft paper towel also can be used to lightly wipe the entire surface of the inked print for the same purpose. Should more inking be required after this procedure, resoak the matrix and surface dry it before going back to brushwork. Otherwise, the gelatin in the areas that you have rubbed will absorb water and the swelling of the gelatin will be uneven. A wet cotton ball or swab also may be used for clearing small details.



A soaking-wet cotton ball lightly wiped on highlight areas can increase contrast and make the highlights sparkle. If fresh ink is needed after rubbing with the cotton ball, the matrix must be resoaked in water to even out the swelling.

■ To achieve an etchinglike quality that emphasizes coarse grain and minimizes detail, use a hog-hair brush with hard ink and a minimum of brushwork. You may find it necessary to add a drop or two of melted candle wax or beeswax to the ink in order to bring it to a proper stiffness. Strive for a bold, broad, overall loose rendering by employing a very rapid brush action followed by a minimum of very light hopping (see following section, Brush Actions for Inking). Use just enough hopping to maintain an even quality of ink on the gelatin. Keep in mind that all ink applications should be applied with the objective of retaining the structure of the coarse grain; hold yourself back on the brushwork! Using crumpled plastic wrap to dab overinked areas can aid in achieving the etchinglike appearance.

Tips (*cont.*)

■ For a more photographic rendering, soak the print in very warm water until the swelling is greater than for hard-ink work. Then use a soft-hair brush with an easy-flowing pigment so that the image easily builds up rapidly. If brushwork is carried too far and too much soft ink is applied, the shadow areas will clog up, which requires one of these remedies: gently dab a ball of plastic wrap on the overinked portion, or place a sheet of tracing paper on top of the image and roll lightly with a brayer until you remove the excess ink. Afterward, even out the ink by hopping with a brush (see following section, Brush Actions for Inking) or rolling rapidly with a clean foam roller.

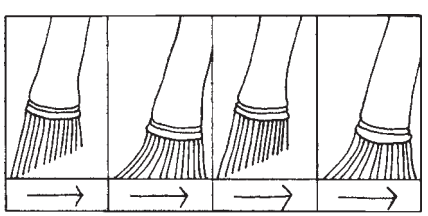
■ To make soft bromoil brushes for hopping and for applying soft ink without grain, visit the cosmetic department of a discount or beauty supply store and purchase either a blush brush, body brush, or cosmetic brush. Badger-hair shaving brushes also are ideal and readily available. Many artist's brushes are made of soft hair and can be easily trimmed into a stag-foot brush.

■ When using the walking-and-dragging or pouncing brush techniques (see the following section, Brush Actions for Inking), warm up the soak 5–10° and thin the ink if the details are not coming in properly after the initial inking stages. Resoak the matrix for 5 minutes while you rework the ink. Thin the ink by adding two pinheads of pure unstiffened ink of the same color. Or, add one small drop of plate oil, stand oil, or linseed oil to the ink from a toothpick. Rework the ink with the palette knife and a small, hard brayer.

■ If you plan to reuse the ink on the inking tiles for retouching or re-inking within 24 hours, keep the tiles air-proof and prevent the ink from drying out by carefully enveloping them in plastic wrap.

Brush Actions for Inking

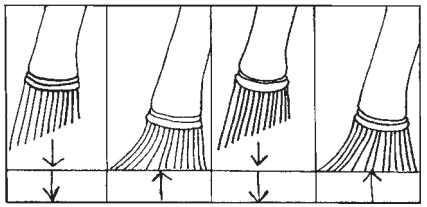
Walking and Dragging



Walking and dragging: The brush is charged with ink, dabbed, dragged, and lifted without the brush completely leaving the matrix surface. The brush is recharged with ink when necessary.

The purpose of the *walking-and-dragging* action is to coat the matrix with an initial thin layer of stiff, greasy ink. Place the toe facing away from you, load the brush with ink, and touch the top left corner of the matrix. Holding the brush firmly at a right angle to the matrix, press down until the heel also touches. Then, relax the pressure and move the brush slightly toward you, leaving a deposit of ink as you go. Repeat this action rapidly but gently while dragging the brush in a line from the top to the bottom of the matrix. When you reach the bottom, the toe of the brush leaves the surface of the matrix for recharging the brush with ink. Otherwise, the toe of the brush never lifts off the matrix. Overlap the original deposit of ink by walking and dragging the brush in a new vertical row. Continue to the bottom, recharge the brush, and repeat the walking-and-dragging procedure until the entire surface of the print is covered with a uniform light layer of ink.

Pouncing



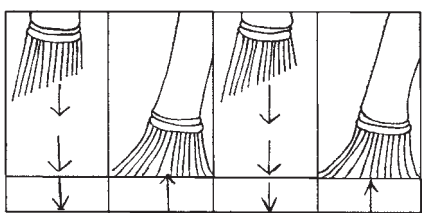
Pouncing: This brush action will clear ink from the highlights and redeposit it in the lower midtones and shadows. Recharge the brush with ink as necessary.

The purpose of the *pouncing* action is to remove excess ink, thereby creating some contrast; to redistribute previously applied ink from the highlights to the midtones and shadow; and to build up the density of the image with additional ink. The brush is held firmly and vertically to the matrix, but now the stroke starts with the toe of the brush turned away from you and held approximately ½ in. (1.25 cm) from the matrix. With a gentle pouncing action, force the brush hairs to expand until the whole surface of the brush is in contact with the gelatin, then allow the bristles to spring away smartly as the brush returns to its original position of ½ in. from the surface. There is no dragging; the strokes should be carried out briskly, yet gently, in a circular pattern, with each stroke separate but close together. The brush should be recharged with ink after every five or six pounces. Pretend the brush is gently kissing the matrix. No force!

Pouncing is the brush action most often used for general bromoil inking. After walking and dragging, pouncing can also be used without ink on the brush to redistribute ink on the print from highlights to shadows. The walking-and-dragging action and pouncing are used together to build up the density of the ink and increase contrast.

A great deal of wrist action goes into pouncing. The forearm stays in a fixed position and the up-and-down motion of pouncing stems entirely from the wrist. The gelatin matrix is delicate, so do not bounce the forearm, or the force will be transferred to the brush bristles, which results in plugged-up shadows.

Hopping



Hopping: You can produce greater contrast and clean the image with this bouncing action. The brush should be cleared of any ink prior to hopping by stippling it on a clean piece of newspaper.

The purpose of the *hopping* action is to bring out the details of the highlights and upper tonal values as well as the shadows through lightening the inked areas. The brush is held vertically as for pouncing, but now it is held loosely and is allowed to slide through the fingers and bounce vertically off the surface of the matrix. The weight of the brush falling about 1 in. (2.5 cm) onto the matrix is the sole force behind the bristles spreading. Hopping is a bouncing, instead of a pouncing, action.

A more forceful hopping action, dropped from 2 in. (5 cm) above the gelatin surface, should be used with extreme caution. Keep the handle vertical and the toe away from you.

Sweeping

To clear detail in the upper values, a more vigorous variation of the hopping stroke, *sweeping*, entails gently whisking the bristle tip across the inked gelatin surface. The brush handle is held at the extreme end away from the bristles. The wrist acts as the fulcrum, and the brush swings like a pendulum while a rapid sweeping motion is executed.

Common Bromoil Inking Mistakes

1. Using too much force with the brush when applying ink, thereby destroying detail and creating an uneven and splotchy print.

2. Going too quickly when inking. Have patience or you may lose some subtle aspects of your print.

3. Inking unevenly, which makes dark smudges on the print. This is often caused by failure to consistently smooth out the ink on the tile.

4. Thinking the print is finished when it actually needs more depth of inking. Prematurely stopping the inking results in faint areas on the image.

5. Generating a print that lacks contrast and is dominated by an overall muddy look. This common error usually is caused by not performing the inking techniques carefully, not applying a good base of stiff ink first, and not using a wedge to clear the highlights.

6. Plugging up the shadows with excessive ink or ink that is far too soft.

7. Using ink that is too soft for the swelling of the matrix, resulting in blocked-up shadow and highlight detail.

8. Using too much ink on the brush, which creates plugged-up shadows and splotches in the print.

9. Failing to remove every water drop from the front and back surfaces of the matrix. This allows moisture to get into the brush bristles and later creates small white spots on the print.

10. Failing to consistently remove small hairs, lint, and bits of trash off the face of the print, causing ink build-up around and over this debris.

Print Finishing and Enhancement

When the bromoil matrix is soaked in water, the gelatin swells, and water retained by the swelling repels the greasy ink. However, when you apply ink to a dry print, the ink will be accepted evenly, both in the highlights and in the shadows. This is a simple concept, but it is also an effective print-finishing technique because selected areas of an image can be strengthened and intensified. You as the bromoil worker have important manipulative controls, such as those listed in the following Tips section.

Tips

- You can dry an inked print for days or months, then re-ink it after a long water soak. In this way you can add a new color or obtain consistency in a series of prints.

- With a semidry or totally dry print, you can darken the edges and corners. Tape two acetate straightedge strips together at a perfect right angle and secure this mask along two of the image's edges as you gently, lightly, and slowly ink the edges of the image. Remember that any over-inking cannot be reduced unless you resoak the print and work the problem out with plastic wrap or hopping.

■ Lightly rub the surface of a completely dry and flat bromoil print with a dry paper towel or piece of soft flannel to increase contrast and give the image more brilliancy. Follow up by swabbing the face of the print with a wet paper towel or wet cosmetic wedge. Use a fast, light touch for both rubbing and swabbing.

■ To produce fine striations on the inked surface, use artist's grade extra-fine steel wool that contains no oil. Lightly wipe the surface of the completely dry print. Before you start this procedure, ask yourself, "Will striations enhance this particular image?" If you are not certain, do not do it, for there is no turning back once you have started!

■ Many bromoilists use Marshall's Oil Pencils or Berol Colored Pencils to hand color a bromoil print. See Chapter 2.

■ Peerless watercolors, designed to sink into the gelatin layer of a photograph, can be used to tint bromoil prints. Their selective application is explained on page 36 of Chapter 2, Hand Coloring. For tinting, add cut pieces of the cardboard color to a tray of water, then soak the entire print in it for approximately 20 minutes.

■ Food coloring, such as that used to dye Easter eggs and cake icing, is available at pharmacies or grocery stores and can also be used for tinting. Mix 8–10 drops in 1 qt (0.95 L) of water and add a tablespoon of white vinegar for brilliancy. Pour this mixture into a tray and immerse the bromoil print with a constant, gentle rocking motion. Pull the print out every few minutes until you have achieved the depth of tinting you want, then blot the print dry.

■ Coffee imparts a yellowish-brown shade to the print. Pour a cup or two of drinking-strength coffee at room temperature into a tray with 1 qt (0.95 L) of water. Soak the bromoil in this solution and pull the print out every 2 minutes for inspection. If you overtint, soak the print in fresh water until the coffee leaches out and reaches the tone that suits you. Tea can be used for a different sepia shade.

■ To mount the finished print, first flatten the picture by dampening the back and placing it overnight under a piece of glass weighted with books. Or, dampen the back and place the print in a dry mount press for 2 minutes at 200°F (93°C). Mount the bromoil print on four-ply, acid-free board with linen tape hinges. A window overmat adds protection.

Care of Bromoil Brushes

Use VMP naphtha and a glass artist's brush-cleaning jar fitted inside with a metal coil for rubbing the brush tips. Clean your brushes after every studio session, but use artist's brush-cleaning

soap only three or four times annually, because it has a tendency to dry the hairs. After cleaning your brushes, hang them to dry with tips facing downward.

With an ordinary hair comb or a wire brush, comb the bristles of your bromoil brushes prior to use. The teeth of the comb or wire brush separate any hairs that are stuck together and keep the brushes in fine order.

For each brush, make a hooded wrapper. Cut a thin plastic, acetate, or cardboard strip and wrap it around the bristles to hold them in place. Put a rubber band snugly around each brush wrapper. Store the brush in the wrapper after each cleaning to protect it and to keep it in proper shape.

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The Fabric of Our Lives, 21 × 27 in. (53.3 × 68.6 cm) photo linen and mixed media, 1983.
Women from Cambridge, Massachusetts' Newton Court and Washington Elms, two of the oldest federal public housing in the United States, worked with the author to produce a one-of-a-kind oral and visual history book about their home and its residents. It was created by printing photographic negatives of images and words on photo linen, which was painted, embroidered, embellished, and stitched.

Chapter 13

Enlargement Emulsions

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From the late nineteenth century, factories manufactured gelatin-silver emulsions that were coated onto papers of various pale colors and thicknesses, glass (also known as lantern slides and dry plates), silk fabric, and even flock paper. Emulsions were first made with gelatin-silver bromide in the 1880s and have been used ever since because the mixture was sensitive enough for an image to be projected, rather than contact-printed, onto it and developed. A more thorough history of silver emulsion starts on page 253.

This chapter will concentrate on silver bromide black-and-white emulsions that can be coated onto a variety of surfaces and handled under an enlarger in a conventional photographic darkroom, yielding a continuous-tone image. Coat-on emulsions are made by numerous companies in the United States and Europe. I remember being so excited after I bought Rockland's Liquid Light in the 1970s that I took the bottle out of the cardboard packaging only to totally ruin it because the container was clear plastic, allowing the emulsion to be exposed in daylight. Very soon after, Rockland started using black opaque bottles! Each brand of coat-on emulsion has its own characteristics, which are appreciated by its fans. In addition to their capabilities on paper, fabric, glass, metal, mirrors, and ceramics, all enlargement emulsions can be toned (Chapter 3) and hand colored (Chapter 2). These emulsions do not require a negative the same size as the finished print but can be enlarged onto in a conventional black-and-white darkroom. They can be purchased premixed in photography stores or ordered directly from the manufacturer (see Supply Sources). They cannot be used in sunlight; a darkroom is required.

Safety

Chapter 5 lists more specific safety recommendations. Make sure your darkroom is well ventilated and that you wear protective gloves when working with enlargement emulsions and photo chemicals.

If you spray, rather than brush, emulsion, you might need a respirator that absorbs fumes. Each product is slightly different, so read the manufacturer's warnings.

Do not ingest; do not apply the emulsion to your skin. Use hot water and soap to remove emulsion from skin.

Method Overview

1. A negative is placed in the enlarger and focused.

2. In a darkroom, emulsion is coated on the support surface, then it is dried.

3. The negative is projected onto the sensitized surface, which is processed in photographic chemicals to yield a positive, continuous-tone image.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio and Chapter 5, "Making Negatives: Analogue Method."

1. Image. Any black-and-white negative or color negative (the results are less detailed) that fits your enlarger system, drawings or photocopies on pieces of acetate slightly larger than the opening in your negative carrier, or real objects such as leaves or flower petals placed in a glass negative carrier will work. You can even work without an enlarger by contact printing the enlarged transparencies you have made for the other light-sensitive processes or placing objects onto a support coated with emulsion, as explained in the Tips section below.

2. Emulsion. They are all-purpose, black-and-white emulsions that can be purchased in half-pint (236.8 ml), pint (500 ml), quart (1 L), and gallon (4 L) light-tight plastic bottles either directly from the manufacturer or from photography stores. Make sure that the instructions are packaged with the emulsion when you buy it. Solid at room temperature, they must be melted to a usable fluid. One pint covers approximately 16 square feet (1.49 square meters) or much more, depending on the surface coated. It can be stored in a refrigerator for up to two years. Do not put it in a freezer. The Rockland Colloid Corporation, the first that I know of to make an enlargement emulsion (Liquid Light, still on the market), will make special emulsions, such as a high-contrast one, on special order. Liquid Light is sold as either a single grade or a variable contrast emulsion. They also can ship antifog solution and AG-Plus, a high-density emulsion with more silver content for coating glass and clear plastics. Rockland makes a toner that allows you to coat onto ceramics and fire the image.

Another similar product on the market is G.A.F. Template Emulsion, but G.A.F. does not like to sell directly to the public. Kentmere (variable contrast emulsion made in England), Maco (Black Magic), Porter (U-Spread), Bergger (EL3), Photographer's Formulary (Formulight Normal, High, or Variable Contrast), Foto Speed and Jessop (Photo Emulsions, made in England and available throughout Europe) make good emulsions and are listed in Supply Sources.

All packages are marked on the outside with an expiration date, but you may want to label the bottle. Make sure it has been kept in a refrigerator where you buy it, then store it cold in your studio. Let it come to room temperature before you bring it into your darkroom to use. Do not unscrew the cap in white light and do not try to save diluted emulsion.

3. Photographic darkroom and chemicals. You will need a conventional darkroom capable of printing black-and-white photographs, and it should include safelights, enlarger system, print easel, and four ridgeless trays. Black-and-white paper developer, fixer with hardener, fixer remover, tongs, and washing system should be used at approximately 68°F (20°C) or slightly cooler. See Chapter 5,

With a Darkroom section, for more details. Do not use a stop bath unless the manufacturer specifically recommends it. Avoid rapid fixers because they can bleach the image. Many of the emulsions are so sensitive to light, even a safelight, that they can fog. So, make sure you use the color safelight that the manufacturer recommends at the proper distance from your enlarger and trays.

For large surfaces the manufacturers recommend using a slide projector with either a black-and-white or color negative. Tape opaque black paper over the front of the lens with a hole approximately ⅛ in. (⅓ cm) in diameter, cut in the middle to act as a diaphragm limiting the light output and sharpening the image. Rockland AG Plus is particularly suited for mural prints.

4. Receiver. Paper, cloth, and raw canvas need no priming, although most raw canvas needs to be washed before being used. Paper is recommended to practice on, no matter what surface you eventually want to use, and you should use rag paper if you care about permanence. The color of the paper, even if it is a bright white versus an off white, will contribute to the emulsion's appearance. A sizing such as gelatin (see Chapter 4) produces a shinier surface, which gives the illusion of a deeper black in the print.

Smooth surfaces, such as fired ceramics, china, enamelware, glass, and ceramic tiles should be scrubbed with hot water and washing soda, sal soda, or sodium carbonate (such as Arm & Hammer washing soda stocked at grocery stores) and 2% chrome alum, or available as an inexpensive "subbing" kit from Rockland. More detailed instructions are included with the kit and a recipe is offered in *Silver Gelatin* (see Reed and Jones in Annotated Bibliography). The preparation must be meticulous and you must leave no fingerprints on the surface. Tips at the end of this section describe my method. Photographer's Formulary makes formaldehyde-free Formulight liquid hardener for coating onto hard surfaces and Formulight liquid gelatine as a separation layer when using metal substrates. (In the United States, Sierra Custom Design [www.tilemagic.com] will reproduce your photos onto tiles. Rossato Giovanni [www.phot-ceramics.com] puts your pictures on porcelain in Italy.) Etched glass does not require such extensive preparation—just a good wash. Rocks and seashells usually need little special preparation other than washing and possible coating with the gelatin size mentioned in the following Tips section. I have even used a first layer of watered-down and dried emulsion without any exposure, but with processing. Clean leather, roughed a bit with fine sandpaper, will work. My students have been frustrated working on plaster because it drinks up the photo chemicals used in processing. So, we have tried sealing the surface with varnish and brushing on developing chemicals with some success.

Another acceptable method for preparing the aforementioned receivers and the recommended technique for metal and preprimed canvas is a fresh coat with alkyd-based primer. For a transparent finish, spray or brush one coat satin or gloss finish urethane-based varnish, which can be thinned with mineral spirits. Rather than degreasing and hardening, to help prevent air bubbles, coat with a foam brush and sand the dry primer or varnish with very fine sandpaper before applying the emulsion. With aluminum litho plates, you need only degrease with alcohol or acetone. Copper should be neutralized with 3–4 oz. (89–118 ml) vinegar mixed with 1 qt (1 L) water. Dry thoroughly afterward. Do not spray, but seal with a coating of matte polyurethane brushed on. Dry thoroughly

again, then apply liquid emulsion.[1] With all these smooth and odd surfaces, let the emulsion set in total darkness for at least 24 hours.

If the receiver is warmed, even with a hair dryer, before coating, the emulsion will spread more easily (see item 8).

5. File cards. Available in stationery stores, 3 × 5 in. (7½ × 12½ cm) index stock file cards or 3 × 5 in. pieces of the same material you will be working on are coated with emulsion and used for testing exposure times and fogging.

6. Applicators. Emulsion can be applied with house painting or artists' brushes; it can be rolled onto canvas or paper, poured, dipped into, or sprayed with an atomizer or air brush. Dilute the emulsion with water for spraying it on, but apply many layers. Clean utensils after contact with emulsion, and stay away from tools made of copper, brass, bronze, or iron, because they will react with the silver in the emulsion. I avoid sponge brushes because I have found that they create air bubbles in the coating. However, I read on www.alt-photo.com, that going to the hardware store and purchasing a very inexpensive Shur Line ceiling trim paint edger with Quick Solution 4 Premium Pad Edger gives really smooth coatings. You have to make sure that you do not buy the disposable brush and handle or the foam pads.

7. Hot water. Very hot (200°F or 93°C) water in a beaker or cup is needed to melt the emulsion. Or use an electric hot water heating coil, available at pharmacies and normally used for boiling water to make coffee. A second beaker of lukewarm water is handy for storing and cleaning used brushes during a printing session; a slightly warm and dry brush makes the emulsion spread more evenly. In addition, emulsion that has not been hardened by fixing can be removed from a surface with hot water. You can also use a crockpot no higher than 120°F to melt emulsion. Keep distilled water warm.

8. Hair dryer. One with a cool setting helps to quickly dry the emulsion. Dry both back and front of the paper or fabric. Do not try to dry the emulsion with heat—this actually retards drying by melting it. You can air dry the emulsion in total darkness. Preheating the support surface with a hair dryer before you apply the emulsion, too, facilitates an even application.

9. Chlorine bleach (optional). Hardened emulsion can be removed from a surface with solutions such as diluted Clorox or Purex. Remove stains from hands with strong soap and hot water. Do not put your hands in fixer as one manufacturer recommends because alum hardener may cause skin irritations and allergies, and boric acid (a buffer in fixer) can be very toxic, with systemic effects.

[1] My students like Black Magic Photo Gelatin for preparing shiny surfaces, used in conjunction with Black Magic Liquid hardener.

Making an Enlargement Emulsion Print



1

Melting the emulsion

Cover coating area with newspaper and place Liquid Light in hot water, cap down. By gently shaking the bottle, ascertain when you have melted only enough to use. Do not shake the bottle vigorously or you will create air bubbles in the emulsion.



2

Preparing the darkroom

Set up the following chemicals at approximately 65°F (18.3°C): Dektol diluted 1:2 parts water, 2 trays of paper fixer with hardener, fixer remover, and water wash.



3

Preparing the test print

Insert the negative into the carrier and the enlarger. With the aperture fully open, focus onto the actual surface you will coat. Adjust the blades of the easel if you are working on paper. If you are coating an object, such as a box, use tape on the enlarger's baseboard to indicate where you will replace the object after removing it for coating. Or, on a sheet of gray paper, trace around the border of the object, then turn off the enlarger light.



4

Making test strips

Thinly coat and dry the Liquid Light onto a spare piece of the same material as the proposed finished piece. Cover up four-fifths of the coating with cardboard and expose the rest for 10 seconds. Move the cardboard so that three-fifths of the coating is covered. Expose another 10 seconds. Continue in this fashion, two-fifths, one-fifth, then remove the cardboard all together.



5

Processing the test print

Rocking the tray, gently agitate the test print, face up, in developer for 2 minutes, first fixer for 30 seconds, and second fixer for 10 minutes or more. Rinse the excess emulsion off the brush and wipe it dry. Gently rinse the print in water.



6

Inspecting the test print

Under white light, choose the test strip that has the richest blacks and most detailed whites. Keep in mind that you can burn and dodge as you would with conventional photographic paper (see pages 102–104).



7



Making the image

Remove the bottle from hot water , dry it, then pour a small amount directly onto the desired surface. Spread a thin coating by working the emulsion in with a clean, dry, warm brush. Holding the receiver at an angle to the safelight, you can see whether you have made a thorough coating because wet emulsion is shiny.

Carefully dry the emulsion, place the receiver under the enlarger, and expose it for the predetermined time. Burn and dodge, then process as in step 5. Afterward, use fixer remover for 2 minutes.

8



Finishing the image

Gently wash paper for 15 minutes; wash nonporous receivers for 1 hour. Do not allow a stream of water to hit the emulsion or you may damage it. Air dry flat.

A damp wrinkled print can be flattened by ironing on the nonemulsion side or with a dry mount press at 175°F (79.5°C) for 30 seconds.

Tips

- If you are inexperienced in a darkroom, read the section, With a Darkroom in Chapter 5, to acclimate you to general procedures.
- Photo Linen, a sturdy and pliable presensitized fabric, is available in sheets or rolls and treated in darkroom chemicals, as described for the coat-on emulsions. It is available from Kentmere in England, Cachet (distributed by Hans O. Mahn in Hamburg, Germany), and Calumet in the United States. Foto Speed can be obtained from Jay House in Wiltshire, England. You can purchase photo linen in sheets or rolls.





■ To keep large pieces of glass and metal warm, which helps ensure a more even coating, I put it over the crock pot or tray of hot water. You can also use an old heating pad set to low. Before you coat, however, you must prepare the hard and shiny surface, either with polyurethane spray or by degreasing. First, make tabs with duck tape and attach them onto the back of the receiver so that you can move the piece from tray to tray without getting (oily) fingerprints on the working plane (see page 14-258, item 5). Then, make a paste of sal soda and water and gently rub it on the surface. Rinse until the water sheets, rather than beads, off. You can dry the substrate in a dish drain.

■ Cachet makes a gelatin for preparing glass, or you can use 2 tablespoons Knox gelatin with 1 cup boiling water. Apply this mixture to the glass with a sponge brush, then allow the glass to sit for 8 hours so the gelatin bonds with the glass. Be careful that no dust or bristles, if you use a paint brush, is captured in the coating. You can also use an atomizer to apply the gelatin, but you should put on one coating, let it partially dry, then apply another coating.

■ Most rocks do not need special cleaning, except ones you find at beaches that are covered with salt. All rocks need a precoat, which is accomplished by mixing one capful of liquid emulsion with 8 oz (236 ml) water and applying this mixture to the rock. Dry it, then intentionally fog this coating by exposing it briefly to white light (a few seconds under the enlarger without a negative), process it in the chemicals and dry it. Next, apply another layer of emulsion and proceed as described later in this chapter. In order to obtain more detail with a three dimensional object, keep the enlarger f/stop as closed down as you can.

■ Emulsion does not work on flannel but is great on cotton and polyester.

■ To make a hard, straight-edged coating, first delineate the area with masking or drafting tape, then apply the emulsion up to the tape and even over it, and let it dry. The tape will loosen up and pull off in the wash water later, leaving an even boundary.

David du Busc. *George W. Bush: "Mission Accomplished" Lunch Box,* **5 × 7 × 3 in., Liquid Emulsion, fabric, metal, plastic, voice chip with improvised pressure switch and improvised text, sand, silver wire. © 2005. Collection of Lydia Millet. Nearly 100 artists were invited to create a unique object to benefit the Cape Cod Children's place in Eastham, MA. The organization provided off-the-shelf metal and plastic lunch boxes. Inspired by conversation about the "liberation" of Falluja, Iraq, du Busc photographed a Bush action figure in front of enlarged photocopies of news pictures. Liquid emulsion was applied to both sides of the lunch box, enlarged onto with negatives from the setup, and developed with black-and-white chemistry. The spoken voice invokes the Faux gravity of a TV commercial with over modulation and a gravelly tone: "George W. Bush is proud to present the 6 Flag Mission Accomplished Lunch Pail. You choose the side that lets 'em know how you feel. Good job? … thumbs up on the Aircraft Carrier Abe Lincoln. Disabused? … My day in Falluja."**



Ann Rosen. *The Crook/Magill Family,* 41 × 45 in. Hand-applied black and white emulsion, oil pastels, charcoal and pencil, wood, 2002.

For over a decade, Rosen has been photographing families and the intermingling of cultures and ethnic and racial groups in Brooklyn, NY. Her project chronicles family diversity as exhibited through intermarriage, biracial adoption, integration, and same-sex marriages. Not only is Rosen inspired by the gestures and relationships of people, but she also is interested in how they describe their lives, which she has edited and written on the frames.

■ Too thin a coating will often appear as a gray, streaked image. For greater tonal range and richer blacks, however, apply two or three *thin* layers, allowing each coating to become almost, but not completely, dry before the next one is applied. Too thick a coating requires longer exposures, and it tends to crack. If emulsion becomes too difficult to spread after it is poured from the bottle, thin it with *up to* 20% warm water. After running tests with Silver Print emulsion graded (*not* variable contrast) emulsion, I have settled on this method: mix 1 part emulsion with 1 part warm distilled water. Coat onto receiver. Let it partially dry, then brush on a second layer of diluted emulsion, stroking in the opposite direction to the first.

■ Add one part working developer with 10 parts emulsion and mix thoroughly before coating to create a more sensitive (faster) and more contrasty emulsion.

■ Wipe the mouth of the bottle and the brush after each use. If the emulsion is exposed to white light and accidentally mixes in with fresh emulsion, the coating can look fogged and gray. Always replace the bottle cap after each use.

■ Enlargement emulsion is easily affected by age and heat; however, emulsion fresh from the manufacturer is not as light-sensitive and may require a longer exposure. As it ages, the emulsion will become faster.

■ With odd-shaped objects, you may want to tape a sheet of gray paper onto the easel and draw the shape's outline on the paper after you focus the negative. This procedure allows you to reposition the object correctly after removing it from the enlarger area and coating it with emulsion.

■ Enlargement emulsion is not quite as light-sensitive as most photographic papers, so keep the enlarger lens one or two stops more open than the image would print on regular photo paper.

■ If you are contact printing an enlarged transparency and do not have access to a darkroom, merely flash an overhead tungsten light bulb in a safe lighted room to expose the emulsion, then process the print as if you had enlarged onto it.

■ If you are air drying the emulsion, which can be important with glass and metal substrates, make sure you do it for 24 hours in *complete* darkness. If you are air drying paper in the dark, it will take approximately 3 hours. In order to prevent fogging, Ann Rosen adds liquid orthozite in the proportion the manufacturer recommends to the developer, but it does cool the blacks a bit. Or try mixing a 10% solution of either potassium or sodium bromide and adding 1 oz. (30 ml) to a quart (1 L) developer to maintain the color.

■ If the emulsion bubbles or peels while you are processing the image, make sure you prepared the receiver correctly. Bubbles will show as little shiny specks on the dried print. Larger bubbles are more noticeable. The best way of preventing bubbles in the coating is to make sure the emulsion is free from them in the first place, by skimming the surface with a glass rod that has been dipped in emulsion and by not shaking the bottle. Other trouble shooting advice is to make sure that you did not use a stop bath, did use a hardener in the fixer, and fixed long enough. Insufficient fixing time or



Joelle Shefts, *Demeter,* 128 × 30 in., oil, acrylix and photo emulsion on canvas, 1999.

Shefts, whose background is in painting, applied four layers of Liquid Light to rigidly stretched canvas primed on the back with rabbit skin glue and prepared on the front with a light layer of acrylix to purposely crack the painting's surface. She enlarged a photo image onto the upper right comer, where she had applied emulsion, and then used a system of pumps, tubes, and troughs to process the still-stretched canvas. Shefts' avocation is the study of comparative mythology, where she finds stories that connect to contemporary life. This piece comes from a series of paintings about the mother-daughter tale of Demeter and Persephone, a story which some scholars have interpreted as depicting two aspects of one persona.

weak/stale fixer also will cause brown splotches. (This is a problem I often see with beginners.) Use Hypochek™, as described on page 5-93, "Fixer," to help avoid such problems.

■ Here is the sure-fire bubbleless coating method relayed to me by Bart DeVito formerly of Luminos: 2 1/4 oz (66.5 ml) emulsion, 1/4 oz. (7.4 ml) distilled water, and 1/4 teaspoon (1 ml) pasteurized heavy cream. Mix gently with a glass rod under the safelight before coating. Artist Ann Rosen uses this recipe for her prints on Saunders Waterford paper.

■ If the image fades over time, it was not washed long enough to remove the fixer.

■ If darkroom chemicals are hotter than 70°F (21°C) the emulsion can melt or smudge.

■ For processing big pictures, when chemical trays may not be large enough to hold the whole image, try either of these methods: (1) After enlarging onto coat-on emulsion the developer can be applied with a sponge or atomizer to a portion of the print at a time. First, lay the receiver down flat. Then use a clean sponge or atomizer to pre-wet the emulsion with cool water where you do *not* want an image, or use Maskoid™ to prevent developer from attacking that area. The water will slow down the developer so that you can go back into that region after you have applied developer to all other areas. You can continue with this method as you stop and fix the print. (2) For developing mural-size images on canvas or paper, use different flower troughs, found in plant nurseries, to hold the different chemicals. Make sure the troughs are long enough to fit your canvas or paper. When you are ready to develop the image, you may need someone to help you roll the paper or canvas through the chemicals in one direction, then unroll the paper or canvas through the chemicals and roll to the other end. Wear protective gloves.

Joelle Schefts's method for processing large work is described to the left.

■ Use of a rapid fixer can bleach or cause yellow stains, while insufficient fixing time or weak/exhausted fixer can cause brown stains in the finished print.

■ Enlargement emulsion usually does not need an after-coating, but if moisture or handling will be a problem, finish a dried image with varnish, shellac, lacquer, acrylic spray, or polymer medium. Please read the next tip for warnings about sprays.

■ To dull a glossy print, apply matte spray, available at art supply stores. Sprays can be toxic if inhaled, so a ventilating mask should be worn when you use them.

■ Enlargement emulsion works beautifully over gum bichromate prints (see Chapter 8). I have successfully coated Silver Print Emulsion directly on egg shells with no surface preparation.

■ The Rockland Colloid Corporation, manufacturer of Liquid Light, will answer specific questions. Their address is listed in Supply Sources.

Making Tintypes by Lana Z Caplan



Lana Z Caplan, *So Much Has Passed, I Can Nearly Forget,* **from the series Dual, 20 × 20 in., tintype, © 2006. Courtesy Gallery NAGA. www.lanazcaplan.com**

As *The Focal Encyclopedia of Photography* (see Zakia and Stroebel in the Annotated Bibliography) explains, tintypes/ferrotypes were first introduced by Frenchman A.A. Martin and had a laterally reversed image like the daguerreotype (See chapter 14). Popular in the 1850s, the ferrotype originally was a black lacquered plate with a wet collodion emulsion, but dry gelatin was used in the 1880s. Because they were cheap, easy to produce, rugged, and fast, the ferrotype played a substantial role in the democratization of photography. Itinerant photographers could develop the plates in trays inside the bellows of the camera or in containers suspended beneath slots in the bottom of the camera. L. Blacklow

There are two ways to make tintypes using liquid enlargement emulsion: use any of the commercially available ones, or visit Kodak's website for a recipe to make your own emulsion.

You can use a large format camera loaded with a coated aluminum (this metal is best because it is thin, light, and will fit) plate fitted in a film holder. Or, you can place the coated plate under an enlarger in the darkroom. Since tintypes are a positive-to-positive process, you will need a color or black-and-white slide (preferable because the enlargement emulsion is sensitive to a range of gray tones, whereas color slides will produce very low contrast images), a transparent black-and-white digital positive (see Chapter 6), or an ortho film positive (see Chapter 5) in the enlarger.

Purchase thin aluminum in the printmaking area of an art store, or look for roofing tin or shimming sheets at the hardware store. Cut the metal to fit the camera's film holder or trim to the finished image size if you are enlarging in a darkroom. Degrease the metal plate as explained earlier in this chapter and then coat with a thin, even layer of black gloss or matte spray paint or asphaltum used by printmakers for hard ground etching and found in an art sore. Wear a ventilating mask, gloves, and protective goggles.

Next, melt the emulsion as described in this chapter, being careful not to bring it to a boil. (I heat a saucepan of water on a hot plate set to medium heat in the darkroom. I put the liquid emulsion bottle in the saucepan and keep it there until I am read to coat.) Warm the metal on a hot plate or on a sheet of glass that is placed over a tray of hot water to help ensure ease of coating.

Under a red safelight, quickly pour the emulsion onto the plate, then spread it by tipping the plate from corner to corner, allowing gravity to move the emulsion across the dry, blackened surface. Then, use your gloved fingers or a glass or Lucite rod to even the coating. Allow the plate to dry flat in a completely dark, cool area, such as a refrigerator—I have a small one in my darkroom—from which you have removed the white light bulb or on top of cold packs on a level surface. The drying area should be dust-free and allow air to circulate, so a tight box is not a good idea.

After one to two hours (depending on the size of the plate and the humidity), you can turn on the safe light and check to see if the coated metal is completely dry. It will appear less glossy and gray, rather than the white color of the freshly coated plate. Now you can insert the plate into the camera with a dark slide over it or place it under the enlarger. A typical exposure on a sunny day in

a 4 × 5 camera varies with the choice of emulsion and thickness of the coating. You will have to make a test strip with a variety of exposures. A 5 × 7 inch (12.7 × 17.78 cm) enlargement in the darkroom with a normal density positive will be approximately 30 seconds to 3 minutes at f/4 with the enlarger lens 3 feet (1 m) above the plate. Again, make test strips (See Chapter 5).

Develop the plate in approximately 25 ounces (750 ml) normal paper developer mixed with 1.2 ounces (35 ml) *exhausted* fixer for one to two minutes. Do *not* use stop bath. Fix for 2–5 minutes, or until all the milky areas have cleared. Final wash in a *gentle* stream of water for 10–20 minutes.

Tips

- When you make test plates with different exposures, make sure you keep careful notes and that you maintain exact development times.

- When the plate is wet, it is fragile, so be careful not to scratch or touch the surface.

- By adding exhausted fixer to the developer, the shadows will clear more fully and reveal the black metal plate. (One way to create exhausted fixer is to pour some stop bath into it, then use Hypochek as explained in Chapter 5.) Exhausted fixer will increase image contrast.

- Developer exhausts quickly and will leave a silver residue on the image, so change the developer after 3–5 plates are put through it.

- I use powdered fixer without hardener.



Jerry Spagnoli, *Firecracker,* 11 × 11 × 11 in., box is birch, steel, and aluminum, 1998. Case is bookboard and leather. Daguerreotype is a quarter plate, 3¼ × 4¼ in. What could be more contemporary than Spagnoli's reliquary of a moment that was over almost as soon as it began? He was thinking about the historic daguerreotype process in relationship to the ephemeral, how the antiquity of the process highlighted the transient nature of its subject. So, he considered what might be the briefest, yet most vibrant instance this medium could record. In a darkroom, Spagnoli sensitized a daguerreotype plate and placed it on top of the box. A firecracker was placed on top of the plate, and a piece of black anodized aluminum was secured over that. The firecracker was set off, and the resultant explosion blew a hole in the aluminum, preserving the shape of the escaping energy and the emitted light. This is the first of 15 for an eventual series of 144.

Chapter 14

Contemporary Daguerreotypes (Becquerel Process)

With assistance from Tyler Treadwell

- Materials 257
- Making a Daguerreotype 261

The daguerreotype is an exceptionally detailed, direct positive image on a polished silver plate. Each daguerreotype is a one of a kind and possesses a presence; most are delicate, defined, of substantive weight, small enough to be held in your hand, when angled change from positive to negative and "transcend reality: [They] appear to float in space behind glass" [1] Given that they are created by the action of photons (fundamental electromagnetic particles) on solid silver, there is no visible grain, unlike modern film. In addition, one sees a mirror image on a mirrorlike surface. See page 32 for a reproduction of a delightful old daguerreotype.

In 1839, Louis-Jacques Mandé Daguerre, a painter of scenes and fabricator of dioramas, gave his name to the first *practical* photographic process using a camera, announced at a meeting and followed by a publication of the French Academy of Science. Legend has it that he accidentally discovered the light sensitivity of silver iodide by leaving a silver spoon on the surface of an iodized plate in the spring of 1831.[2] But he rode on the shoulders of centuries of experimenters. For instance, historians know that simple lenses had been around Europe since the thirteenth century in the form of eye glasses and probably before that in the Middle East (Arabian mathematician Ibn Sahl calculated the shape of lenses at the end of the first millennium C.E.; scholar Alhazen wrote about lenses and their relationship to the human eye 300 years later) and in ancient Greece (a burning lens was mentioned in a play by Aristophanes in 424 B.C.E.). In the mid-seventeenth century, J. C. Sturm created a portable camera obscura, a light-tight box with a reflex mirror and focusing lens, based on the original camera obscura, which was a darkened room with a pinhole that directed light rays to form an inverted image on a screen, as described first by Chinese philosopher Mo-Tin in the fifth century B.C.E. William Wollaston in 1812 devised the first landscape lens, with approximately an f/14 aperture. This British inventor also worked on creating the camera lucida, used as a drawing aid and consisting of a flat surface on which drawing paper was placed, then connected to an armature with a lens/prism system above.[3] The "artist" would look through the lens and see the paper and the

[1] Artist's statement by daguerreotypist and sculptor Alyssa C. Salomon.
[2] Crawford, William. *The Keepers of Light*. Dobbs Ferry, NY: Morgan & Morgan, 1979, p. 25.
[3] One of the more carefully crafted, modern camera lucida for purchase, made by Roger Vaughan of Camera Lucida, is listed in Supply Sources.

scene, which she or he would "trace." Although this procedure sounds easy, we know that men like William Henry Fox Talbot were frustrated by their inability to render, and that frustration drove Talbot to develop "photogenic drawing," as he called his new invention of photography.[4] However, we know that even in the Renaissance, artists Leonardo DaVinci, who also wrote about his use of the camera obscura, an Italian term that means darkened room, and Canaletto in Italy, Albrecht Durer in Germany, and Dutch painter Jan Vermeer used optical devices to help create their artworks, although the camera obscura was mainly used to safely observe the sun and solar eclipses.

Meanwhile, in 1725–1727, German chemist, Dr. Johann H. Schulze, experimented with the light sensitivity of silver coatings until he mixed chalk, nitric acid, and silver in a flask, accidentally creating the first light-sensitive amalgam, when he noticed a darkening on the side of the flask exposed to sunlight. He also disproved that heat could have the same effect. Although Schulze could not figure out how to make permanent the contact prints he made from stencils with this mixture, modern photography really was an expansion of his findings. Early in the nineteenth century, Thomas Wedgwood made silhouettes of sitters and, along with Sir Humphrey Davy, contact printed photograms of opaque objects by coating silver nitrate on leather (you can coat silver-based Enlargement Emulsion (see Chapter 13) and Van Dyke brown solution on leather; see Chapter 8), but again, they could not figure out how to make the images stable when shown in light stronger than that emitted by a candle.

J. Nicéphore Niépce[5] had figured out, by 1817, how to partially fix a silver chloride (silver salted) negative on paper that had been inserted in a camera lucida. Some consider him the inventor of photography because, by 1826, he had taken the first photograph, a direct positive, from nature with a camera, using a pewter plate coated with bitumen of Judea (a petroleum product), exposed for 8 hours, and washed in oil of lavender. Niépce was the first to use a camera with a bellows for focusing and an iris diaphragm for different f/stops. Daguerre partnered with Niépce, and they experimented with a polished silver plate coated with tree resin and distilled oil of lavender mixed with alcohol, sensitized with iodine fumes, and inserted in a camera lucida. Niépce died before the big breakthrough created by Daguerre's further experiments, based on coating a copper plate with silver, fuming it with iodine vapors to form silver iodide, exposing the plate soon after, developing it in (extremely toxic) heated mercury fumes and fixing the image in salt and water, which he eventually changed to sodium thiosulfate (suggested by Sir John Herschel of cyanotype fame), then rinsing the plate in water. In 1840, Alexander-Edmond Becquerel, who was one from a line of scientific family members, introduced a less dangerous process, closely related to the method described in this chapter: a silver-coated daguerreotype plate fumed with iodine vapors and underexposed in a

[4] In British society, an educated man had to be able to draw, so Talbot named his book about his invention, *The Pencil of Nature*. He rushed to make public his discovery of 1835 when he heard about Daguerre. He used a portable camera obscura fitted with a microscope lens to make a negative, then a positive from that negative, of a window at his home, Lacock Abbey, now a museum near Oxford, England. His was the first editioned book with photo illustrations.
[5] Niépce also made the first photo etching, a contact print from a drawing of Pope Pius. The basis of this process became the foundation for daguerreotype. In addition, he was the first to understand the principal of a latent, or invisible, image that becomes apparent through development.

camera, developed/intensified by a secondary after-exposure under red glass (which eliminated the need for mercury), fixed, and washed.

As Alyssa Salomon pointed out in an e-mail to me, in the mid-nineteenth century, the study of photography, light, and optics captured the best minds of the generation, much the way high-tech has done in our era.



Alyssa Salomon, *Trio*, 4 × 5 in. Becquerel Daguerreotype, 2001.

Another quote, this time from Salomon's artist statement: "We see only light reflecting off the world, never the world itself." www.newdags.com/alyssa.html

Safety

Susan Shaw and Monona Rossol, in *Overexposure: Health Hazards in Photography*, a book I respect and recommend as indispensable, advise practitioners only to use the Becquerel process for one reason: the traditional daguerreotype uses mercury. To paraphraze Shaw and Rossol, most forms of mercury are extremely hazardous, even if proper precautions are taken and expensive industrial ventilation is used. In addition, the cost of proper environmental disposal of mercury is prohibitive for most photographers. Mercury vapors are odorless, hard to detect, and almost impossible to control in the environment and on clothing. Not only are mercury salts corrosive to the skin, but they also affect the mucous membranes and the respiratory tract.

Acute or chronic mercury poisoning primarily affects the nervous system but also severely damages the gastrointestinal system and kidneys. Symptoms such as muscle tremors, irritability, and psychic disturbances were well known by the mid-nineteenth century among hatters who used mercuric nitrate to make felt hats; thus, the expression "mad as a hatter." Some early Daguerreotypists probably suffered from mercury poisoning.

Iodine vapors are hazardous by inhalation (acute and chronic respiratory problems), ingestion (intense corrosive damage and may be fatal, even in small amounts), and concentrated exposure to skin (deep, slow healing ulcers and hypersensitivity reaction) and eyes (severe and painful burns). Chronic exposure to iodine halogens can cause severe symptoms of poisoning and nervous system damage. *Make sure there is local ventilation of vapors and you always wear goggles, gloves, and a proper respirator.* In *The World Journal of Post-Factory Photography*, Issue 4, Dec. 1999 (see Annotated Bibliography), Bob Schramm describes building a fuming hood as follows: I found a blower unit with plastic fan blade and sealed motor designed to exhaust a large darkroom, which I figured meant it could really suck air … out of a small fume hood and withstand corrosive chemicals. The fume hood is about 3 ft (0.9 m) square by 4 ft (1.2 m) high, with an interior waterproof electrical receptacle, a red safelight with a white work light. The vertically sliding glass door on the front is made from a storm window. The frame is two by fours bolted together. The top, bottom, and side panels are ¾ in. and ½ in. marine plywood screwed onto the frame, sealed at every joint with silicone. Internal surfaces got several coats of black enamel, caulked with more silicone. The blower exhausts air into a 6 in. (15.25 cm) diameter duct that goes through the wall and up over the studio roofline. … I also installed a red light and a sign outside the studio which says "Do Not Enter The Studio When The Red Light Is On!" But I keep the door locked anyway. Smart and considerate man! A simple test for the effectiveness of a hood is a lit candle at the opening where your face and body will be. The flame should bend toward the vent and away from you.

Gold chloride is moderately irritating, but can cause severe skin and respiratory allergies if not handled properly, and chronic inhalation can cause anemia, liver, kidney, and nervous system damage. It is usually used with sodium thiosulfate (i.e., sodium hyposulfite, hypo, fixer) in the gilding stage. This second chemical is highly toxic by inhalation, and ingesting large quantities can cause purging. Old hypo solutions can decompose and form toxic sulfur dioxide gas. Do not heat sodium thiosulfate nor contaminate it with acid unless you do so in a fume hood. Discard used hypo responsibly.

Wear gloves, goggles, and respirator with acid gas and dust cartridges throughout the polishing, sensitizing, and fixing procedures.

Always store chemicals away from your living space and out of the reach of children and pets.

Method Overview

1. A metallic plate is coated evenly with silver, polished, then exposed at 70°F (21.1°C) to iodine crystals that emit iodine fumes and combine to produce silver iodide, a light-sensitive amalgam.

2. The plate is inserted in a camera and exposed to directed light.

3. After removing the plate from the camera, it is further intensified by "continuation rays" (Becquerel's term) to bright light beneath red rubylith or orange amberlith acetate.

4. Under a safelight, the plate is fixed in a solution of sodium thiosulfate and water, and unused iodine crystals are removed, revealing the image more clearly.

5. The image is washed and may be gilded in gold chloride solution for more permanence and to help harden the image.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1. Plate. Daguerreotypist Eric Rickart uses recycled copper roofing plates, which he must have electroplated with silver. But the most reliable method for a beginner is to buy precoated plates. The only source I have found for precoated plates in the United States is Theiss Plating and Mike Robinson's Century Darkroom in Canada, both of which are listed in Supply Sources. After you receive the plates, inspect them for imperfections before you use/pay for them. We found that the silver layer can be used three times at most, providing you polish it before each use, although Alyssa Salomon reports that she uses her plates more than three times. After the silver is worn, you can send the plate to Theta Plating, listed in Supply Sources, for replating. In addition, Theta will coat a polished copper plate you provide them. The plates from Theiss, which have a brass base, sometimes appear to be two sided, but there is a "wrong" side (just remnant silver from the plating process) and a thicker, smoother coating, which is the "right" side. It appears that Theiss also experiments with the metal upon which the silver is plated, so each shipment can be of different thickness no matter what you request. Daguerreotypist Bob Shlaer makes relatively inexpensive and easy-to-use test strips by cutting pieces of sterling silver flat wire, available from jewelry-making suppliers, but the light-sensitivity of such metal may be different from the plate you use. Still, I think this method suggests some creative uses for an image on metal!

2. Contact printing frame. The frame should be larger than the plate and will be used when you develop the exposed plate under rubylith to sunlight. However, if you choose not to use a camera but to contact print a negative onto the sensitized plate, a frame is indispensable. If you do not want to buy one, I have described how to make a frame in Chapter 4.

3. Large-format camera, black focusing cloth, and "altered" film holder or antique plate holder. Daguerreotype plates are thicker than sheet film, so a traditional film holder must be used *without* the dark slide, which would scratch the plate if forced. Instead of a dark slide, you can carefully put the loaded film holder into an opaque black plastic bag. Although you have to insert the plate into the camera once you are in bright light, the short amount of time between taking the film holder with plate out of the black bag and entering it into the camera will have no affect if you are quick.

In addition, you can prepare three narrow strips of matte board the same thickness as the plate, approximately ⅛ in. (2 cm), and same width as the frame of the film holder. Glue each strip along the front edges of the film holder, thus compensating, like a shim, for the thickness of the plate, after focusing. Daguerreotypist extraordinaire Jerry Spagnoli uses a different method: he racks the back of the film plane area (rear extension) backward to match the thickness of the plate after he focuses.

If you find an antique plate holder, you need not worry about scratching the plate; the dark slide does not touch the silver surface and you need not worry about making up for the focus problem. Another choice is the Kodak film pack holders, which are available on eBay and should be even more plentiful due to their obsolescence now that Kodak no longer makes 4 × 5 in. sheet film packs. Cut two pieces of black foam core the size of the holder to fill the gap between the back and the plate. These film pack holders have many advantages: you load the plate from the back so you do not touch the fragile front, they are compatible with Graflock-backs for many large-format cameras, they require no expensive adaptations, and the plate is in the same plane as the ground glass,

so no focusing adjustment is required. The film pack holders can be purchased in different small sizes, but the 4 × 5 in. back fits similar sized plates perfectly.

4. Opaque black bag. You can recycle and reuse the plastic that photo paper is packaged in, make a wrapping from 4 ml mulching plastic found in a good hardware store, or order black plastic bags from Recognition Systems/AFM Products (see Supply Sources). If you find an antique plate holder made for daguerreotypy, you need not worry about black bags. We have not talked to a daguerreotypist who has said that inserting the plate into a film holder without scratching it is easy, and we assume that one of the reasons that the oldtimers used mattes around their images was to hide the edge imperfections.

5. Strong tape, ruler, and scissors. Because you should not touch the plate once it is polished, or you might deposit fingerprints, make a "lift" from cloth tape secured to the back and doubled over onto itself. (This system can be used when coating metal with liquid enlargement emulsion, see Chapter 13). In addition, we use scissors to precut strips of tape so we can attach the plate to a Pyrex™ container's cover when we are fuming it. A ruler is handy after focusing as explained below.

6. Tripod. The exposures probably will be around 2–5 minutes, so the camera needs to be still if you want to control the clarity.

7. Trays. You will need two nonmetallic photo trays or glass baking dishes; one will be for fixer and one will be for water. You may want a third for a final bath of distilled water.

8. Desk lamp or night light with 15- to 25-watt bulb. When you are sensitizing the plate in a darkened room, you need to see the color change from the affects of the iodine vapors. If you direct a desk lamp away from the plate and towards a wall 3 feet away, you will have enough light. The nineteenth-century method was to secure yellow tissue over a small window. Still, for the last five seconds of the fuming, no light should be on.

9. Two buffs of velvet or chamois. One buff will be used for rouge, available from jewelry suppliers, and the other will be kept clean. At the school where I teach, there is an excellent buffing system in the small metals area. However, you can buy a bench grinding wheel at a hardware store, remove the grindstones, and replace them with soft cloth polishing wheels. Better yet, daguerreotypist Bob Schramm recommends purchasing a polisher from a jewelry supply company because it will have no vibrations that could cause fine scratches in the silver. To reuse a plate, polishing is a crucial step in making a proper surface for daguerreotyping, and our predecessors used deerskin. Mike Robinson of Century Darkroom (see Supply Sources) makes a swing-arm polishing stand modeled after nineteenth-century Boston, Massachusetts, daguerreotypists Southworth and Hawes. If you look at some of the old texts, such as *Silver Sunbeam* (see Towler in Annotated Bibliography) or go online, you might find that you can build yourself a buffing stand with wood boards and clamps. Machine polish, then hand buff to achieve a mirror-black finish. We found this phase full of challenges, such as not scratching the plate and keeping it free of contaminates, but success can be in the polishing.

10. Vacuum cleaner. The small particles of silver that fly when you are buffing should not be breathed in. Additionally, after your studio session, vacuuming your buffing and working area while wearing a respirator is good for your health and to keep plates dust-free.

11. Mattes of acid-free board. Even if you do not want to present your daguerreotype in the traditional way once it is finished, you will need to create a matte so that the plate does not touch the rubylith and glass in the contact frame during the making of the image. Cut a window approximately 1/16 in. (1 cm) smaller on each side than the edges of the plate. In addition, when fuming the plate in a Pyrex™ box, Alyssa Salomon wonders if you could try cutting a double matte to hold the plate to the cover. Cut one matte out of ridge cardboard the size of the plate, another slightly smaller. Glue the two together on three sides. Place the plate in the holder face down and tape the matte to the lid such that the plate is between the smaller matte and the lid.

12. Fuming box or Pyrex™ dish with top and photo tape. You can buy a walnut fuming box, complete with a glass lidded insert, from Mike Robinson at Century Darkroom (see Supply Sources) for the best system. Until you know that you are committed to this process and want to invest in expensive equipment, we suggest you go to a grocery store and buy a glass storage container larger than the plate and approximately 4 in. (10.25 mm) deep. It comes with a plastic top that fits tightly.

13. Exposure meter. The approximate ISO of a sensitized plate is 0.004, but you can use the meter to keep notes on how bright the light (the exposure value) is as compared to how long the exposure is. Note time of day (exposures late in the afternoon and in the morning are significantly different than at other times because the light can be golden and because of the filtering affect of the atmosphere). The exposure has to be in the range of 1½ stops over or under in order to see an image. If you know the old zone system, you can meter for the whites and then locate the darkest areas in relationship to the highlights. The tonal range in the scene is the number of stops between the lightest and darkest points, yet Becquerel plates only can reproduce as much as 3 stops, but this is a rarity, with the beginner getting 1½.

14. Thermometer and siphon washer. You will need a darkroom thermometer to measure the temperature of wet ingredients and keep them around 68°F (20°C). In addition, the room temperature should be near 70°F (21°C) when fuming the plate. The siphon washer helps to direct a gentle stream of water over the plate as the last step.

15. White gloves. We used white cotton gloves whenever we handled the dry plate in order to avoid contaminating it with fingerprints. You can also use disposable unpowdered nitrile and latex gloves; the fit is snug and there is no extra lint.

16. Hair dryer. If you warm the plate before exposing it to the iodine vapors, you will help ensure a more even sensitizing layer, but do not warm the iodine crystals. A hair dryer will also remove condensation, which we found formed due to cold weather. If the weather gets too cold, expose indoors through a window.

17. Timer/watch. You will need to time the exposure and development under rubylith.

18. Notebook and pen. We cannot emphasize enough how important it is to take detailed notes. Daguerreotyping takes quite a bit of work to control, and your efforts will be made easier if you have careful notes on each step.

19. Chemicals. Pure crystal iodine, available from Photographer's Formulary (see Supply Sources) sensitizes the plate; you will need 1 oz (30 g) of the flaky, not ball, type, which lasts indefinitely if

properly handled and stored. Unfortunately, the Formulary cannot ship it outside the United States. Sodium thiosulfate (specify "pentahydrate," which is easier to mix in water), available from the Formulary or Bostick & Sullivan (see Supply Sources), fixes the plate; you will need at least ½ lb (250 g) because you have to mix fresh fixer with each studio session. A 5% solution of gold chloride, available through either of the aforementioned suppliers, is used to gild the daguerreotype. A solid brass gilding stand can be purchased through Mike Robinson.

20. Protective gloves, respirator, goggles, lab coat that stays in your work space. Store the respirator in a sealed plastic bag to lengthen its life. A small funnel helps pour the iodine back into a bottle after use. For the hand polishing stage, wear heavier gloves such as rubber-coated garden gloves, but *do not* use those gloves when you actually work in the garden!

21. Rubylith or amberlith. These colored acetates are used in the offset printing business and are available through Recognition Systems (see Supply Sources). We have purchased rubylith from a good stationer, such as Bob Slate (see Supply Sources) also.

22. Glass and Filmoplast p-90 tape or similar archival tape (optional). Available at Light Impressions and framing stores, these supplies are used for the traditional presentation of a daguerrotype image under sealed glass and in some kind of protective case, to avoid dust and scratching the surface. The tape is also helpful for making sure no iodine fumes leak out of the storage bottle.

Tips

- Commercial daguerreotype studios often placed a sitter in front of large windows to get maximum light. The walls were painted white, and mirrors were employed to reflect more light onto the subject, who was encouraged not to dress in blue and to use powder to whiten the face. This information inspired Alyssa Salomon: "I have painted still-life objects a matte pale blue to manage tonal ranges." Since the plates were—and still are—only sensitive to blue light, blue glass over windows would reduce the concentration of light without decreasing its effect on the plate, while making the studio more comfortable and reducing the posing time for the customer. This description may give you an idea of the amount of light needed, but remember that daguerreotypes, made in the traditional manner with bromine fumes and mercury development, are much more light-sensitive than the becquerel process.

- Due to the lens optics, you always get a mirror image of the subject.

- The image was made more obvious and more stable by *gold toning*, also known as *gilding*. Most daguerreotypes, except the earliest ones, were gold toned by using a special holder with an adjusting screw to clamp the plate horizontally, and then pouring a small volume of (usually) dilute gold chloride solution over the image. The plate was heated from below with a spirit lamp (a lamp that burns a volatile liquid fuel such as alcohol) to speed the reaction. When it had reached the right color, the gold chloride was poured off, the plate rinsed with distilled water and then dried over the spirit lamp.[6]

[6] Marshall, Peter. http://photographpy.about.com/library/weekly.

Tips (*cont.*)

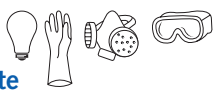
- The original daguerreotypes were covered with glass, framed in oval or specially shaped brass mattes, and housed in leather locking cases lined with velvet. However, if you look at dagazine online, you will see wonderful examples of other presentations from the collection of Matthew Isenburg, www.ccsd.ca/charlotte/dagazine/mi/exhibit. These include a jewelry box, cameo, watch fob, lockets, snuff box, calling card box, appointment book, purse, and cosmetic case.

- Carefully storing the chemicals after you are done is important. We found that, after we poured the iodine crystals back into its brown bottle and locked it in a fireproof metal cabinet, paper and acetate on a nearby shelf turned brown. So, we kept the crystals in its glass bottle and sealed the top with electrical tape (you can also use Filmoplast tape), then put the bottle in a locking plastic bag to prevent future leaks. The tape may eventually become brittle due to the corrosive affects of the iodine, so check if you need to replace it. In addition, we put a desiccant, recycled from vitamin pills, in the bag in order to prevent a moisture problem. You can also buy calcium chloride desiccant in a hardware store. If you have a fuming hood, store the iodine there.

Making a Daguerreotype

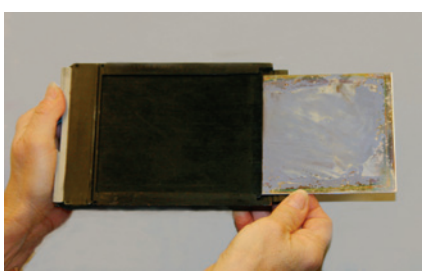


1



Preparing the plate

Use black tape around the outside of the Pyrex™ dish and top. With precut pieces of Photo tape, attach the plate to the dish's top or insert it in the fuming box slot, silver facing down. Either be careful not to touch the plate surface or wear cotton gloves. Heat the plate with a hair dryer. In a well-ventilated area, pour an even layer of iodine crystals into the glass receptacle. Put the top on and make sure it fits tightly.

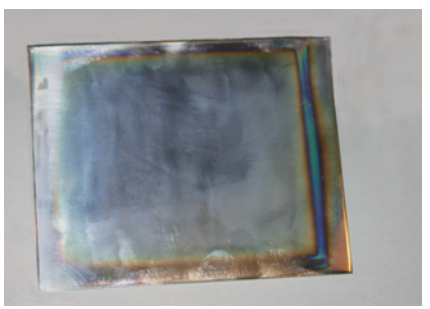


3

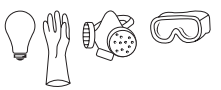


Finish preparing the plate

Turn off the light and fume the plate for 5 seconds more. With a safelight on, quickly remove the tape from the plate and carefully put it in the film holder, sensitized side visible. Wrap the holder and plate in opaque plastic, making sure not to touch the sensitized surface. Or, insert the plate into a film pack holder and insert the dark slide.

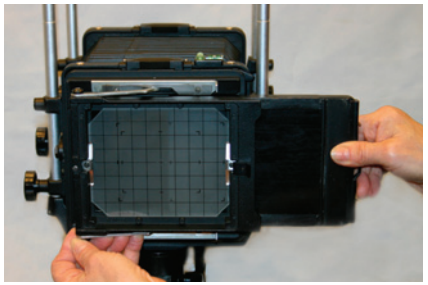


2



Fuming the plate

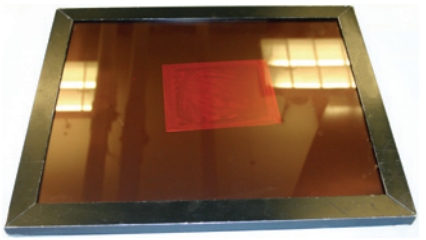
Wait 20 seconds then quickly take off the cover of the Pyrex™ or slide out the plate from the fuming box. Check the color. The silver should have turned pale yellow. Put the top back on for 15 seconds. Take the top off, and you will see the silver change from yellow to pale orange. Put the top back on for 20 seconds, and when you look again, the plate should have turned to a pale purple. We found this first cycle of color, all pastel shades, took 55 seconds. Keep checking the color every 15 seconds, and you will see the plate go through a second, more saturated sequence of color that starts with deep yellow in 30 more seconds, deep magenta in 25 more seconds, and clearly blue-green in 20 more seconds. In a proper fuming box, the times will be shorter. (This second cycle is optional, as some find it tends to make the final image muddy in the blacks.)



4

Setting up the camera

Secure the camera to the tripod and focus through the ground glass. Quickly remove the film holder and plate from the black bag and insert it into the camera back, plate toward the lens. Open the camera lens to f/5.6, and leave the lens open for approximately 1½ minutes on a sunny day or in an environment with lots of reflected light. We found longer exposures were needed on overcast New England days. After the exposure, remove the plate and holder and swiftly put it back in the opaque bag. Do not be disappointed if you do not see an image—you shouldn't!

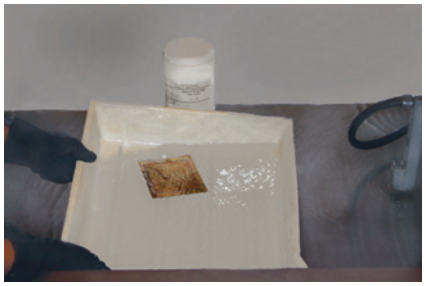


5

Developing the plate

Open the back of the print frame and, under a safelight, place the plate, face up, on top of the inside backing. Position the precut matte above the plate, then the sheet of rubylith on top, making sure it does not touch the plate. Last, put the glass on and close the unit. Take it to the sun and let it develop for approximately 1 hour in indirect summer light or direct overcast light.

Afterward, bring the unit to a room with subdued tungsten light, and remove the layers to see if the plate has turned a light gray, like tarnished silver. You should see a faint image at this point. If it is magenta, it needs more development.



6

Fixing and washing the plate

In a tray, mix 1 oz (28 g or 2 tablespoons) hypo with 32 oz (900 ml) water at 68°F (20°C); always use fresh fixer. If you can smell a strong odor from the fixer, it is too old or too strong. Gently rock the plate in the hypo for 30 seconds. Under subdued light you should see the image start to clear as the unused iodine is removed. Leave the plate in the fixer for twice that time (the rule of thumb is, "twice the time it takes to clear"). Move it (the tape lifts in item 5, materials will help you) to the wash tray, but not in the stream of gently running water for 1 minute, then to a still bath of distilled water for a final soak of 1 minute.

Immediately air dry it on a slight angle so that the water runs off.

Tips

- We found this technique to be one of the most difficult we had ever attempted; it takes a lot of patience, careful notes, and analysis. We were fortunate to contact experienced artists—daguerreotypists seem to be a small and closely-knit group—who were forthcoming with advice. If you can find a good workshop or demonstration on the becquerel process, we recommend it.
- Keep the room temperature at approximately 70°F (21°C) as you sensitize the plate. If the room is cooler, sensitizing will take longer. You might wait 5–10 minutes for the sensitizer to stabilize before exposing the plate, but if you wait much longer than that to continue the procedures after fuming, you may create problems.
- Begin by taking pictures outdoors. If your camera is focused on many neutral tones, try to get a bit of sky in your first trial exposures.



Alyssa Salomon, *It's My Land Too*, **4 × 5 in., traditional daguerreotype, 2004.**

Tips (*cont.*)

- To trouble shoot, be aware that problems usually occur in the polishing, fuming, or exposing stages.
- The plate will be clear if you underexpose in the camera. Overexposure, common even with the originators of the process, can turn a portion of the image, such as the sky, blue. (I find it charming.)
- When developing out with the rubylith, do not put the plate on blacktop or other heat-absorbing surfaces. Additionally, avoid resting the plate on grass or plants because they give off moisture. If you note any condensation while you are developing the plate, a hair dryer will eliminate the problem.
- The image will be blue or magenta if you underdevelop it in the print frame.
- Page 226 of *Overexposure: Health Hazards in Photography* (see Shaw and Rossol in Annotated Bibliography) states: "Fixing of Becquerel is done with a weak solution of salt and water; a zinc or aluminum rod is used to galvanize the silver iodide layer. This method minimizes image fading, which tends to occur if the plate is fixed in hypo."
- Because the $^{5}/_{10,000}$ in. (0.5 mm) silver coating and the plate do not actually absorb chemicals, a brief final wash suffices.
- The earliest method for hand coloring Daguerreotypes was to spread a thin layer of varnish onto the image after fixing, washing, and drying. This coating allowed powdered pigment mixed with gum arabic to be applied with a fine brush or cotton. (See color plate and illustration at the beginning of Chapter 2.)



Juliana Swatko, *Blue Bird,* 16 × 20 in. Manipulated chromogenic print, 2000.
Born in New York, Juliana Swatko has lived near Sydney, Australia, since 1979. She received a Bachelor's of Fine Arts from Tyler School of Art in Philadelphia and a Master's of Fine Arts from Visual Studies Workshop in Rochester, New York. Swatko has been head of Photomedia in the Design Degree at University of Western Sydney's Communication Arts School since 1997, and a lecturer there since 1991. Her work has been shown nationally and internationally and is included in many collections, including the George Eastman House International Museum of Photography, The Art Gallery of New South Wales, the Australian National Gallery, Art Bank, and Visual Studies Workshop's Research Center.

Chapter 15

Alternative Color Exposure and Printing Processes

Juliana Swatko

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  - Multiple Exposures
  - Using Black-and-White Negatives As Color Printing Masks
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From the very start of photography and the invention of the daguerreotype (see Chapter 14) in 1839, the search for "realistic" color began. Daguerre even stated that the only feature needed to finish his revolutionary invention was naturalistic color.[1] Alexander-Edmond Becquerel, described in Chapter 14 is considered by many historians to be the founding father of color photography for achieving natural, albeit impermanent, color direct positive Daguerreotypes in 1848.

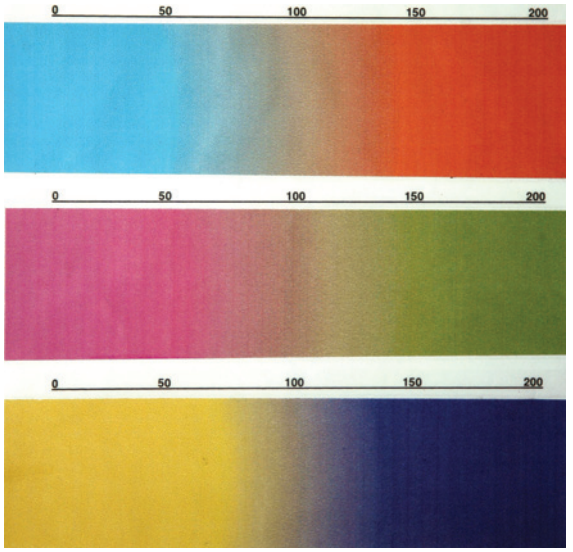
In 1850, a daguerreotypist and minister, Levi L. Hill, of rural New York, made some Daguerreotypes, also known as hillotypes, that produced different colors on one image, but his process, which he called *heliocromy*, was complex, dangerous, and not necessarily "naturalistic."

Eleven years later, a British physicist, James Clerk Maxwell, devised a way to create a trichromatic color image for his slide lectures. He made three black-and-white negatives—the emulsion was only sensitive to blue light—by exposing film through three color filters (red, green, and blue) on the camera. He then made three black-and-white positive lantern slides, which he superimposed, registered, and projected through the same colored filters on three separate projectors. At the least, his process was unwieldy. Probably building on Wilhelm Zenker's 1868 clarification of why, when the spectrum from light was allowed to fall on moist silver chloride paper, some of the colors were recorded, Frenchmen Louis Ducos du Hauron and Charles Cros announced in 1869 that, by combining cyan, magenta, and yellow dyes, one could subtract colors from white light. This principle became the basis for carbon and carbro printing, dye transfer, and contemporary color photography. However, these processes, like gum bichromate printing (see Chapter 9) were cumbersome and not practical for small cameras. With the introduction of Autochrome film in 1907 by French brothers Antoine and

[1] London, Barbara, and John Upton. *Photography*, 5th ed. New York: Harper Collins College Publishers, 1994, p. 404.

Louis Lumière, a practical color material (a glass plate covered with tiny grains of potato starch and dyes) was born. Not unlike Pointillist paintings and television, the Lumière method depended on the premise that the human eye would blend together little dots of red, green, and blue colors to make all the visible colors. In 1935, two amateur photographic researchers, Leopold Mannes and Leopold Godowsky, eventually joined forces with Kodak to produce Kodachrome film. With a single exposure, Kodachrome and its competitor Agfachrome, offered color accuracy, image resolution, permanence, and ease of use. Since then, many other films and improvements have been introduced.

—Laura Blacklow



Complimentary colors as connected in color enlargers filters. Color filter → effects color in the print: Cyan ↔ Red; Magenta ↔ Green; Yellow ↔ Blue.

One of the pleasing aspects of photography is that feeling of surprise when an unexpected phenomenon appears in an image. By utilizing color photographic materials in a nontraditional manner, one can be assured of unusual convergences. Outlined in this chapter are a few strategies to produce color photographs with surprising results.

Working with alternative color involves understanding the fundamental principles of photography and photographic materials, as well as the behavior of projected light. The three primary colors in light used in color photographic materials are red, green, and blue, which are linked to their complimentary colors, cyan, magenta, and yellow. In printing a color photograph, complimentary colors correspond to one another by employing color filters in an enlarger. Increasing the amount of density of any color filter will cause a decrease of that color's complimentary color in the resulting print, while a decrease of a filter's density will create an increase of the complimentary color in the resulting print. ("Less is more and more is less" is a good way to remember this principle.) For instance, the figure to the left shows that increased magenta filtration effects the amount of green that appears in a print. (Note: only magenta and yellow filters are used in normal color printing.)

There are a number of avenues for producing color manipulation of the image, and my favorites are outlined below.

Safety

Make sure you respect all the chemicals used in these processes; read the Safety section of Chapter 5, about black and white chemistry before you start. Also, be meticulous about protecting your skin and eyes from the color stabilizer, activator, and acids.

Avoid overheating solutions. Make sure you properly ventilate your darkroom, and wear an approved respirator with an organic vapor and acid gas cartridge. If the stabilizer has formaldehyde, use a respirator with a formaldehyde (which is in developer and bleach fix) cartridge as well.

Method Overview

1. Color film image may be developed in the "wrong" chemistry (cross processing) or exposed in the wrong type of light for the type of film chosen, or the same frame may be exposed more than once in the camera.

2. Image from step 1 above and/or black-and-white transparency is enlarged or contact printed onto color photographic paper in a darkroom. The combination, such as two negatives, can be viewed on the light box in advance to see the composition.

3. The photographic paper is processed in conventional RA4 color chemicals.

Materials

1. Image. Different methods for obtaining an in-camera image are described below. Depending on your choice, you may need color print or slide film or overhead transparencies, black-and-white negatives (35 mm to 4 × 5 in.), or enlarged negatives (see With a Darkroom in Chapter 5). This chapter explains how to cross process and multiply expose color films.

2. Equipment. You can send your exposed film to a professional lab for both development and printing, or you will need a conventional color darkroom, including a color head enlarger and RA4 processor, easel, timer, color photographic paper, and requisite chemicals for processing color paper. The RA4 processor is standard for making color prints from negatives, and its resultant image is called a chromogenic print. I do not advise that you develop your own color film.

3. Masks. Frames from 35 mm black-and-white positive film or negatives proofed to lith film act as half of the finished image. The 35 mm positive or negative eventually will be sandwiched in the enlarger's film carrier with a color negative. The two separate images can be viewed together on a light table in advance to see the composition.

Otherwise, by using contact-printing-sized, black-and-white, high contrast or continuous tone lith film images (described in Chapter 5) as a printing mask, you can combine black-and-white negatives with a color image in a single print. You can merge a variety of pictures in an open ended and unpredictable way, and it is an interesting means to utilize your enlarged negatives made for other alternative processes in a new way. (This method functions in a similar way to multiply exposing black-and-white and color subject matter in layers on a single frame of color film (see "An image made from negative," page 270), in that the color image only shows through the clear areas on the enlarged negative while the midtone areas allow the pictures to bond both the color and the black-and-white, and the result of this amalgamation can be quite extraordinary.

4. Miscellaneous. A permanent marker pen for writing information on the back of the test prints can be helpful for keeping track of your procedure. I make notes on the backs of my commercial lab proof prints, which I use only to make image selections. Color viewing filters, available from a photography store, help you figure out the color balance of a print. Scissors. I use a borderless photographic easel instead of glass for ensuring alignment and contact between the enlarged lith negative and the color photographic paper, because it is dangerous to use glass in total darkness. Beware that the lith film becomes attached by static to the photo paper.

The other factor involved when using the color printing process I will be detailing, is the behavior of multiple negatives on a photographic print; when more than one negative is involved (for instance, utilizing a black-and-white and a color negative together), the black-and-white negative forms a mask for the color image to print through. A number of color manipulation methods are outlined below.

Alternative Film Techniques

Cross Processing

By using color film in a manner not intended by the manufacturer, one can create variations on normal color. *Cross processing* your color film entails deliberately developing slide film in chemistry intended for negative film, or processing negative film in chemistry normally intended for slide film. Because the main difference between the makeup of negative and positive film is a masking layer found in the negative film (an overall reddish brown color that reduces contrast when color printing), it is not an issue to use the "irregular" chemistry. (Some of my students have been questioned, usually by nonphotographer technicians, when they bring a roll of film to a minilab for cross processing. This technique does not affect the chemistry.)

Color Films Come in Two Types: Positive and Negative.

Positive

Normally processed in E6 chemistry, positive film is known as slide or is labeled with the suffix "chrome," and it produces a color positive on film, which is viewed by transmitted light. The package may be marked "reversal" due to the way it is normally processed—it actually starts as a negative and is customarily processed into a positive.

However, if slide film is processed in the C41 chemistry normally intended for negative color film, the result is a negative, which does not have any masking layer and looks different from a conventional negative. The contrast in a print made from such a negative is greatly increased. Since contrast in color printing is not a variable that ordinarily can be adjusted (as in black-and-white using multigrade filters), cross processing is a means of effecting contrast and can produce striking results when used with colorful subject matter. There may be some aberration of the color, and colors tend to be much more saturated. With some film types, a magenta glow appears in areas where darks and lights meet.



Bracketed slide film, processed in negative chemistry (no pushing clip test needed).

Tips

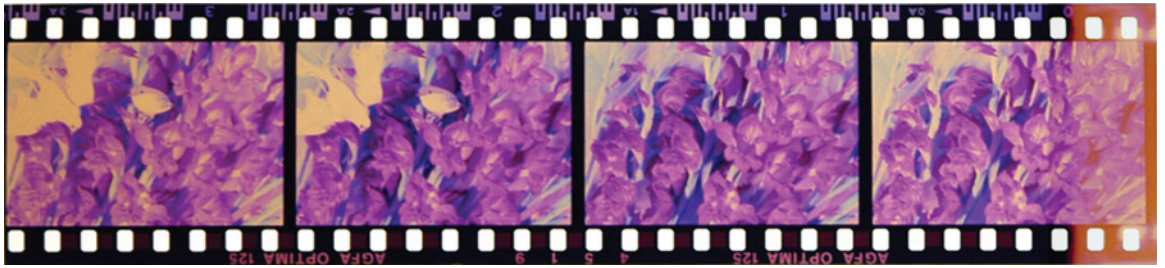
- It is a good idea to do some film tests to find the brand that suits your vision.
- Interesting color results may also be gained by using Tungsten film, shot under fluorescent light and then cross processed, which produces high-contrast and vibrant blues.



A print made using slide film processed in negative chemistry. Note vibrant color saturation.

Negative

Normally processed in C41 chemistry, negative film is also known as print film and produces a color negative, which is usually printed on photographic paper. However, if color negatives are processed in E6 chemistry, normally intended for slide film, the emulsion tends to pick up speed in the processing, thus producing an underexposed negative. You can compensate for this problem by *push processing* (increasing the normal developing time) usually by two stops. Pushing the development is not a hard-and-fast rule but depends on the subject and lighting conditions, so you will need to experiment. Be aware that the masking layer tends to produce a pinkish cast to the film when cross processed, but the tint decreases with push processing.



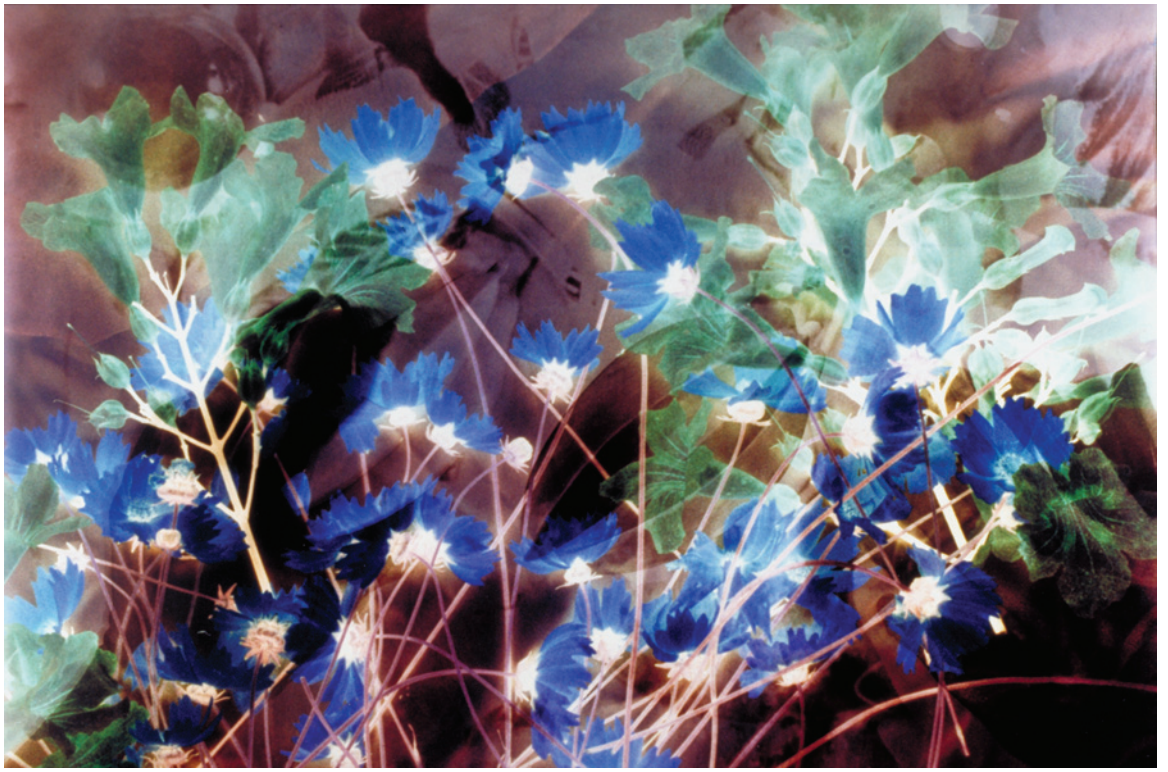
Clip test of bracketed negative film processed in slide chemistry, pushed two stops in the processing at the lab. The film was used as part of the *Blue Bird* image at the beginning of this chapter.

Tips

- It is advisable to do a preliminary test film. A professional lab can clip short pieces off your roll of shot film, then push process in E6 chemistry for one, two, and three stops of overdevelopment. When you evaluate the results, you can determine the appropriate number of stops you need to push future rolls of film, shot under the same conditions.
- With the wide range of slide film available, resulting negatives may have unusual color aberrations, and each brand produces a different color bias. These color qualities can be used effectively

with the multiple printing process described below. Prints made from cross-processed positive film will print in negative colors, yielding high contrast and rich color.

Films also come in two sorts, for different light conditions: daylight film and tungsten film. If you purposely shoot in the "wrong" light and then cross process the roll, you can create some unusual color results.



An image made from negative film processed in slide chemistry. Note image color is a contrasty negative print.

Daylight Film

Balanced for 5500 K on the Kelvin scale (a calculation that indicates color temperature of light sources), this film normally is used in daylight or with studio or electronic flash, which is the equivalent of daylight.

Tungsten Film (Type B)

Balanced for 3200 K on the Kelvin scale, this film normally is used with 3200 tungsten photographic lights.

Multiple Exposures

Another means of combining images for use in alternative color is shooting multiple exposures on the same frame of film. This technique differs from multiple printing, described later in this chapter, because in the places where exposures combine on the film, they build the negative up, producing a lighter area in the print. Therefore, any region of black or dark shadow in one exposure will contain the multiple image and any areas of white or bright highlight will be obscured.

You can produce graphic effects if you consider where different parts of each exposure's subject matter will merge. A sharp visual memory assists the photographer, as seen below in the following picture on page 272.



Only dark areas will fill with the second image, within a multiple in-camera exposure.

With every exposure you make on the same frame, you would normally be doubling the amount of light that hits the film's emulsion. For a correct exposure, you need to deliberately underexpose by one stop for every frame that is layered. Past a point, you would capture very little, so I advise a maximum of three exposures on the same frame.

You can use the camera in two ways in order to produce multiple exposed film. The first option is to use the multiple-exposure function on the camera. This utility allows a number of exposures to be made on the same frame without the film advancing, but you must remember to underexpose deliberately by one stop for each exposure.



In-camera multiple exposure with one stop underexposed for each exposure.



Film run through a camera twice, showing nonaligned frames and creating unusual conjuncture of images.



Black-and-white copy combined with textural color image.

The second option is to rewind the film and run it through the camera again.

For each pass through the camera, you must underexpose by one stop in order to halve the amount of light reaching the film, or you will end up with negatives too dense to print.

The easiest way to underexpose is to move the ISO setting to twice the rating for the film. For instance, if the film is rated at ISO 200, shoot it at 400, and you will be shooting at half the correct exposure but creating the whole exposure when multiply exposed frames are merged.

The rewind method is somewhat unpredictable because the frame edges do not generally line up on the second go-round, so the film has new divisions that can provide an interesting break up to the compositions. It is also impossible to predict what the images will look like in the end, so you can generate some unexpected results, given the way the images layer on film.

Note: Ask the lab not to cut the film for the most choices of composition.

Another interesting method is to use color film but to shoot black-and-white subjects in the first shot, such as a still life or black-and-white art, on a copy stand, and then to combine this imagery with color images, either shot out in the world or shot again on the copy stand using color prints. While using a copy stand is somewhat more predictable in terms of what images are brought together, it is still unpredictable in terms of how the images will actually merge together.

Multiple Printing

Using black-and-white negative printing masks is a method that combines a number of images in a single print from a variety of sources. They can be combined in an open ended and unpredictable way, and this is an interesting technique that can bring enlarged negatives made for other alternative processes into a new area.

Similar in principle to shooting black-and-white and color layers on a color film in that the image only passes through the clear areas on the enlarged negative but the midtone areas join the black-and-white with the color image (see more detailed explanation on page 271), the result of this process can be special. You will need a color darkroom with RA4 processor, light table, easel, and color photographic paper, as well as color film negatives or positives of any format, either cross processed, multiply exposed, or "normal." For the mask, you will need large-format black-and-white lith film negatives (see Chapter 5) or 35 mm black-and-white positive film. These conventional films would be sandwiched in the film carrier with a color negative, but can be viewed together on the light table in advance to see the composition. An enlarged lith film negative will need to be contact printed. The mask is half of the image and will only allow the color image to pass through in its clear and midtone, but not its dense, areas. Prints produced in this way show brilliant whites, due to the fact that the dense blacks prevent any exposure onto the paper.

Using Black-and-White Negatives As Color Printing Masks







1

Selecting the images

Using a light table, compare your contact-size black-and-white negatives and camera-generated color negatives and determine the sort of combinations that you feel may work. Keep in mind that structure and contrast in the originals determine the layers and detail in the finished print. Most likely, you will want to pick a color negative that holds up during enlargement, knowing that the lith negative will function solely as a mask providing compositional structure.

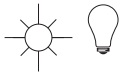
2

Making a Test Strip

In the color darkroom, position your color film in the enlarger's film carrier, set the enlargement, focus and color filtration, and position the easel as you would for making a color print with the negative. Make a test print, as you would normally do for a regular color print, with at least five different exposures so that you will be able to judge the correct exposure and color balance. I usually start at f/11 for 10-second increments for a 16 × 20 in. (40 × 50 cm) print. Put the test paper through the processor.



3



Determining the right exposure

You can use a color correction viewing filter to check your test prints and determine the correct time and filtration settings. Ideally, view the print under the lighting conditions where you expect it to be seen; a gallery may use daylight balanced bulbs, whereas a domestic environment may employ tungsten bulbs.



4

Including the mask

In order to determine how much more exposure will be needed for the print with the mask, position the lith negative on the easel and over a small piece of unexposed color paper while the color film is in the carrier. Enlarge the color image through the lith transparency. At this point, you usually need to double the exposure time or open the lens up one stop.



5

Making a full size print

Once this test has been put through the color processor, you will have a reasonable idea as to the exposure time needed. It can sometimes be considerably more time, depending on the density of the black-and-white lith negative used.

Make a full-size test print with the same setup as you used for the test print. Simply smooth the negative down gently with your hand to guarantee contact between the lith negative and the color paper.

Tips

- Due to static cling, you can eliminate glass for contact printing and still get a good result. I have found glass to be more of a problem due to dust and marks.
- You can dodge and burn, if you think you need it after viewing the full-size print, then you would make another, more final print.
- This printing method is always a surprising and invigorating way to generate new imagery.
- Based on imagery, process, and technique, each person can create unique and personal images, due to the layering and visual convergences within each image. The results could not be produced by any other method.

Chromoskedasic Painting, by Laura Blacklow

Chromoskedasic, a term coined by B. W. Rossiter of Kodak, means color by light scattering. Black-and-white photographic papers contain silver salts that form tiny particles when exposed to light and chemicals. Silver particles that are roughly the same size will scatter certain wavelengths of light and absorb others, producing a specific color.

Artist Birgit Blyth has been applying color photo chemicals onto black and white photo paper. She was inspired by a November, 1991 article in "Scientific American" written by Dominic Man-Kit Lam with Alexandra J. Baran. I will summarize it here, along with Blyth's advice.

Safety

- Make sure you respect these chemicals; heed the Safety section of Chapter 5 before you start.
- Be meticulous about protecting your skin and eyes from color stabilizer, activator, and acids; they are extremely dangerous.
- Avoid overheating solutions.
- Make sure you properly ventilate your darkroom; wear an approved respirator with an organic vapor and acid gas cartridge (and, if the stabilizer has formaldehyde, use a respirator with a formaldehyde cartridge). Never pour water into a concentrated acid, but carefully add the acid to water.

Mr. Lam advises practitioners to assemble all necessary materials and dilute all needed solutions before removing the photographic paper from its protective box.



Birgit Blyth, *Untitled,* 16 × 20 in. (40.6 × 50.8 cm), chromoskedasic painting. Blyth enlarged onto Ilford Multi Grade Pearl photographic paper using a negative she had taken of a "mature" potato that had grown roots. She then applied stabilizer and activator to the paper's emulsion, not knowing exactly what results she would obtain. Blyth is attracted to the chromoskedasic process because of the mystery and experimentation it allows her, a balance between control and surprise. She also uses matte paper so that she can easily apply oil pastels afterwards.

Materials

1. Black and white darkroom (see Chapter 5 or traditional photography book).

2. Black-and-white photographic paper (different papers, based on their silver content, yield different results, and warm tone versus cool tone paper produce slightly different colors), one part Kodak Ektamatic S30 or other color Stabilizer diluted with 9 or 10 parts water at 68°F (20°C), one part Kodak S2 or other color Activator mixed with 9 or 10 parts of water, Dektol or equivalent paper developer diluted to half the working strength recommended by the manufacturer, water, stop bath for black and white paper, and black and white paper-strength fixer without hardener.

3. Water for washing the print.

Making a Chromoskedasic Print

You can start with or without a photographic image. If you want a photographic image, enlarge as you would normally onto black-and-white photographic paper under safelit conditions, then immediately after you have exposed the paper to the image, do *not* develop and process it, but go to the following paragraph. If you do not care about a photographic image, begin by exposing black-and-white photo paper to dim red light for approximately 5 minutes, then proceed to the next stage.

Under a safelight, pour ¼ to ½ cup (59–118 ml) of the 10% stabilizer solution onto the paper and swirl it in a desired pattern. You can see areas emerge as light yellow. Next, pour a small amount of 10% activator solution followed by 50% paper developer solution. These chemicals produce reds, oranges, yellows, greens, blues, and grays. Expose the paper to a fluorescent lamp light for 5 minutes; in areas where no chemistry has hit the paper, it will turn pink. Finally, immerse the paper in a bath of fixer for a minute, then turn the fluorescent lights on, and you can watch the color changes occur. Carefully rinse the paper with water and allow it to dry. Sometimes the colors change further with washing.

There are many possible variations on these directions. For instance, you can selectively administer the color chemicals before enlarging, wash the paper, place Plexiglas™ or masonite under it, then enlarge onto the paper and process as you would normally for a black-and-white photograph. Or, if you put the paper in developer with a white light on before you put it in fixer, the paper will turn black where no chemicals have been painted.

Sometimes Blyth begins by applying rubber cement or Maskoid to prevent an area of paper from staining. Then, she paints with a brush or sprays the chemicals with an atomizer. Lam suggests using a rag to spread solution or a fountain pen dipped in the activator for drawing an outline. Sometimes he finishes the chemically-treated paper by exposing it to fluorescent light for 30 minutes, then he applies a 50% solution of fixer with a spray bottle over the entire piece of photographic paper. After

20 minutes, he washes the paper with water and air dries it. *Wear a high quality respirator, gloves, and goggles.*

Tips

- You can purchase liquid stock activator and stabilizer solutions in quart bottles as special order items at a good photo store or online.
- The temperature of the chemicals effects the colors produced.
- Berg toners can be selectively applied after your chromoskedasic picture is done to further change colors (see Chapter 3).
- Any matte paper, after painted chromoskedasically and dried, easily takes hand-coloring techniques (see Chapter 2).

Annotated Bibliography

Many of these books are available through Photo-Eye, 376 Garcia Street, Santa Fe, NM 87501, USA. (Tel: 505-988-5152, www.photoeye.com/e-mail: webmaster@photoeye.com)

History and Theory

Atkins, Anna, with text by Lynn J. Schaaf. *Sun Gardens: Victorian Photograms.* New York: Aperture, 1985.

Boni, Albert. *Photographic Literature.* New York: Morgan & Morgan, 1962. International bibliographic guide to general and specialized literature on photographic materials and applications.

Bruce, David, ed. *Sun Pictures.* Greenwich, CT: New York Graphic Society Ltd., 1973. Reproductions of Hill-Adamson calotypes from the Victorian era.

Buckland, Gail. *Fox Talbot and the Invention of Photography.* Boston: David T. Godine, 1980.

Eder, Joseph Maria. *History of Photography.* New York: Columbia University Press, 1945.

Gassan, Arnold. *A Chronology of Photography: A Critical Survey of the History of Photography as a Medium of Art.* Athens, OH: Handbook Co., 1972.

Gernsheim, Alison, and Helmut Gernsheim. *Creative Photography.* New York: Bonanza Books, 1962. History from 1826–1962.

Gernsheim, Helmut. *The Origins of Photography.* Revised 3rd ed. New York: Thames on Hudson, Inc., 1982.

Gilbert, George. *Photography: The Early Years.* New York: Harper & Row Publishers, Inc., 1980.

Holme, Bryan, ed. *The Gallery of World Photography/Photography as Fine Art.* Tokyo: Shueisha Publishing, 1983. Three-part series of paperbacks with fine reproductions ranging from the obscure to the famous.

Ivins, William M., Jr. *Prints and Visual Communication.* Cambridge, MA: MIT Press, 1978. A significant text on the history and understanding of prints.

John Michael Kohler Arts Center. *The Alternative Image. An Aesthetic and Technical Exploration of Nonconventional Photographic Printing Processes.* Sheboygan, WI: John Michael Kohler Arts Center, 1984.

Jones, Bernard, ed. *Encyclopedia of Photography.* New York: Arno, 1974. Reprint of 1911 edition of *Cassell's Cyclopedia of Photography.* Includes formulae. Available through Ayer Co. Publishers (www.ayerpub.com).

Jones, Bernard, ed. *The Encyclopaedia of Early Photography.* London: Bishopsgate Press, Ltd., 1985.

Jussim, Estelle. *Visual Communication and the Graphic Arts: Photographic Technologies in the 19th Century.* New York: R.R. Bowker Co. (a Xerox Education Company), 1974. Furthers Ivins' theories with insight into photomechanical processes and advertising.

Kraus, Hans P., Jr., research and text by Larry J. Schaaf. *Sun Pictures: The Harold White Collection of Works by William Henry Fox Talbot.* New York: Hans P. Kraus, Jr. Fine Photographs, 1987.

Lietze, Ernst. *Modern Heliographic Processes.* Rochester, NY: Visual Studies Workshop Press, 1976. Reprint of 1888 text, including formulae for brown and blue printing and toners for them.

McCabe, Constance. *Steiglitz in the Darkroom.* Washington, DC: National Gallery of Art, 1993. Pamphlet includes microscopic blowups of Alfred Steiglitz's different print techniques.

McDermott, David, Peter McGough, and Mark Alice Durant. *A History of Photography.* Arena Editions, 1998. Salt prints, gum, palladium, and cyanotpes about contemporary culture.

Nadeau, Luis. *Encyclopedia of Printing, Photographic, and Photomechanical Processes: Volumes 1 and 2.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau. Information on over 1,500 reproduction processes.

Rexer Lyle. *Photography's Antiquarian Avant Garde. The New Wave in Old Processes.* New York: Harry N. Abrams, 2002.

Romer, Grant B., and Brian Wallis, eds. *Young America: The Daguerreotypes of Southworth and Hawes.* New York: ICP/Steidl Publishing, 2006. Catalogue from an exhibition about the 1845–1862 partners from Boston who photographed many notable Americans and scenes, such as Niagara Falls and Civil War volunteers in a downtown park. When you see essays by Romer (of the Eastman House Museum) or the insightful Wallis (from New York's ICP), read them. You will be provoked, I am sure. Fascinating array of reproductions, and it's not just because I live in the Boston area.

Talbot, William Henry Fox. *The Pencil of Nature.* New York: DeCapo Press, 1969. A facsimile of the 1844–1846 edition, with an introduction by photo historian Beaumont Newhall.

Time-Life Books. *Caring for Photographs.* New York: Time-Life Books, 1972. Contains a chapter by George Tice on platinum printing.

Time-Life Books. *Frontiers of Photography.* New York: Time-Life Books, 1972. Chapters on "Mixing the Media" and "Photography's Changing Images."

Time-Life Books. *The Print.* New York: Time-Life Books, 1975. Chapters and great reproductions on "A Revolution in Printmaking."

Towler, J. *The Silver Sunbeam: A Practical and Theoretical Text Book on Sundrawing and Photographic Printing.* Dobbs Ferry, NY: Morgan & Morgan, 1969. Reprint of 1864 edition.

Wall, E. J., and F. J. Mortimer. *The Dictionary of Photography.* Boston: American Photographic, 1938.

Ward, John, and Sara Stevenson. *Printed Light: The Scientific Art of William Henry Fox Talbot and David Octavius Hill with Robert Adamson.* Edinburgh: H.M.S.O. (for the) Scottish National Portrait Gallery, 1986.

Wilde, Ann, and Jurgen Wilde, eds. *Karl Blossfeldt: Working Collages.* Cambridge, MA, and London: M.I.T. Press, 2001. Translated from a Schirmer/Mosel edition in German. Brilliant turn-of-the-nineteenth-century proponent of the New Objectivity in German Photography also made contact print sheets of cyanotype images collaged with brown and gray photographic prints. Never before shown, and amazing!

Wilson, Edward Livingstone. *Wilson's Photographics.* Reprint of 1881 ed. P.O. Box 958, Salem, NH: Ayer Co. Pub. (www.ayerpub.com) A series of lessons, accompanied by notes, of all the processes that are "needful in the art of photography."

Witkin, Lee D., and Barbara London. *The Photograph Collector's Guide.* Boston: Little, Brown and Co., 1979.

Zakia, Richard, and Leslie Stroebel. *The Focal Encyclopedia of Photography.* Boston and London: Focal Press, 1993. Well-researched, comprehensive array of subjects and an explanation of just about anything you could want to know about photography from its beginning to digital. Extraordinarily reliable.

Contemporary Practitioners

Alt, Alfons, Sophie Biass-Fabiani, and Sally Bonn. *Alfons Alt: The Nature of the Beast.* England: Dewi Lewis Publishing, 2001. Hand-coated emulsion portraits of animals.

Bowman, Stanley. *Translations: Photographic Images with New Forms.* Ithaca, NY: Herbert F. Johnson Museum of Art, Cornell University, 1979. Reproductions of work by Fichter (see the color plate in the Gum chapter of this book); Cowin, Heinecken, and J. Lyons (see her quilts in the Cyanotype chapter of this book); Nettles, H. H. Smith, and Walker (his work is the opener for the Gum Bichromate chapter of this book), others.

Chadwick, Helen. *Enfleshings.* New York: Aperture Press, 1989. Extraordinary use of liquid emulsion and photocopies in provocative installation by a British artist.

Clark, Denis Miller. *Within This Garden: Photographs by Ruth Thorne-Thomsen.* Chicago: Aperture/The Museum of Contemporary Photography, Columbia College, 1993. Pinhole images that defy our expectations.

Coe, Brian, and Mark Haworth-Booth. *A Guide to Early Photographic Processes.* London: Victoria and Albert Museum and Hurtwoood Press, 1983.

Coleman, A. D., and Lynn Warren, eds. *Robert Heinecken: Photographist.* Chicago: Museum of Contemporary Art, 1999. Pictures of all major work in the 30-year career of this innovator and conceptual artist.

Dugdale, John. *Lengthening the Shadows Before Nightfall.* Santa Fe, NM: Twin Palms, 1995. Reproductions of 8 × 10 in. cyanotypes.

Ess, Barbara. *I Am Not This Body: Photographs by Barbara Ess.* New York: Aperture Foundation, 2001. Pinhole pictures.

Fuss, Adam. *Pinhole Photographs.* Washington, DC: Smithsonian Institution Press, 1996.

Grundberg, Andy, and Robert Rosenblum. *Mike and Doug Starn.* New York: Harry N. Abrams, 1990. Inventive use of materials, from toned photo murals to ortho film as the image.

Hitchcock, Barbara. *The Polaroid Book.* Los Angeles: Taschen America, 2004. Comprehensive survey of the Polaroid Collection, showcasing over 400 artworks. Why did I fill out all the paperwork after being invited to add my work, then forget to mail it in? This book is terrific!

Hitchcock, Barbara, and Deborah Klochko. *Innovation/Imagination: 50 Years of Polaroid Photography.* New York: Harry N. Abrams, 1999.

Hoy, Anne H. *Fabrications: Staged, Altered, and Appropriated Photographs.* New York: Abbeville Press, 1988.

Lissel, Edgar. *Räume/Rooms 1996–2000.* Austria: EIKON Sonderdruck #5, Wien, 2000. The artist has used entire rooms to construct pinhole cameras.

Luciana, James, and Judith Watts. *The Art of Enhanced Photography: Beyond the Photographic Image.* Gloucester, MA: Rockport Publishers, 1999.

Morell, Abelardo. *A Camera in a Room, Smithsonian.* Washington, DC: Smithsonian Institute Press,1999. Pinhole black-and-white photographs.

Nettles, Bea. *Flamingo in the Dark, Knights of Assissi, Turning Fifty* are but a few of the self-published titles. Urban, IL: Inky Press. E-mail nettles@ux1.cso.uiuc.edu or fax 217-337-0096.

O'Neil, Elaine, and Julia Hess. *Mother Daughter: Posing as Ourselves.* Durham, N.C., Center for Documentary Studies, Duke University Press, 2006. Selenium toned black-and-white photographs that span over two decades.

Spagnoli, Jerry. *Jerry Spagnoli: Daguerreotypes.* New York: self published. Distributed Art Publications, Inc. 2006.

Walker, Todd. *Todd Walker Photographs.* Carmel, CA: Friends of Photography, 1985. See page (9-184) of this book for but one image from a lifetime of innovative printmaking.

General How-to Books

Airey, Theresa. *Creative Photo-Printmaking.* New York: Amphoto Books, 1996.

Anderson, Christina. *Alternative Processes Condensed.* Self-published, Bozeman, 2005. www.alternativephotography.com.

Anderson, Christina. *Experimental Photography Workbook, Fourth Edition.* Self-published, Bozeman, 2005. www.alternativephotgraphy.com. Fifty-plus processes, student work examples.

Arnow, Jan. *Handbook of Alternative Photographic Processes.* New York: Van Nostrand Reinhold, 1982. Over thirty processes.

Barnier, John, ed. *Coming into Focus: A Step-by-Step Guide to Alternative Photographic Printing Processes.* San Francisco: Chronicle Books, 2000. One of the only available contemporary descriptions on daguerreotypes before my chapter.

Crawford, William. *The Keepers of Light: A History and Working Guide to Early Photographic Processes.* Dobbs Ferry, NY: Morgan & Morgan, Inc., 1979. Entertaining history and detailed directions on gum, blue, brown, and other processes.

Ctein. *Post Exposure: Advanced Techniques for the Photographic Printer.* 2nd ed. Boston: Focal Press, 2000.

Enfield, Jill. *Photo Imaging: A Complete Guide to Alternative Processes.* New York: Amphoto, 2002. Many techniques, including tintype and kallitype.

Eshbaugh, Mark L., *Alternative Photography Processes*. Westford, MA: RMR Press, 2006.

Farber, Richard. *Historic Photographic Processes.* New York: Allworth Press, 1998.

Flynn, Deborah. *Imaging with Light Sensitive Materials.* Rochester, NY: Visual Studies Workshop Press, 1978.

Frederick, Peter. *Creative Sunprinting.* Boston and London: Focal Press, 1980.

Gassan, Arnold. *Handbook for Contemporary Photographers.* Rochester, NY: Light Impressions Corp., 1977. Chapters on black-and-white, color, and nonsilver (photo-printing) techniques and on color critiquing.

Hattersley, Ralph. *Photographic Printing.* Englewood Cliffs, NJ: Prentice-Hall, 1977. Chapters on duplicating film, photographic silkscreen printing, special-effects screens, cyanotype, negative and print retouching and coloring, and mural prints.

Hindley, Geoffrey. *Working with Light-Sensitive Materials.* New York: Van Nostrand Reinhold, 1978.

Hirsh, Robert. *Photographic Possibilities: The Expressive Use of Ideas, Materials, and Processes.* Boston: Focal Press, 1991. Mostly about black-and-white photography, but chapters on toning, widely used alternative processes, and altering photographic concepts.

Horenstein, Henry. *The Photographer's Source.* New York: Pond Press/Simon & Schuster, 1989. This catalogue of equipment, workshops, services, etc., also includes chapters on hand-coloring, pinhole, and nonsilver processes.

House, Suda. *Artistic Photographic Processes.* New York: Amphoto Books, 1981.

Howell-Koehler, Nancy. *Photo Art Processes.* Worcester, MA: Davis Publications, 1980.

James, Christopher. *The Book of Alternative Photographic Processes.* Albany, NY: Delmar, 2002.

Kodak Publications. *Creative Darkroom Techniques.* Rochester, NY: Kodak Publications, 1973. Gum, photo-silkscreen, toning, and other special effects.

Kosar, Jaromir. *Light Sensitive Systems: Chemistry and Application of Non-Silver/Halide Photographic Processes.* New York: John Wiley and Sons, 1965.

Nettles, Bea. *Breaking the Rules: A Photomedia Cookbook, Third Edition.* Box 725, Urbana, IL: Inky Press, 1992. Assumes reader knows black-and-white darkroom technique, but many color reproductions of this influential artist's work. www.beanettles.com/bookorder/bookdescriptions.html.

Newman, Thelma R. *Innovative Printmaking.* New York: Crown Publishers, Inc., 1977. Two- and three-dimensional prints; photo and nonphoto methods with and without a printing press.

Reed, Martin, and Randall Webb. *Alternative Photographic Processes: A Working Guide for Image Makers.* Sterling Publishers, 2000.

Reed, Martin, and Randal Webb. *Spirits of Salt.* London: Argentum Press, 1999.

Reeve, Catherine, and Marilyn Sward. *The New Photography: A Guide to New Images, Processes, and Display Techniques for Photographers.* Englewood Cliffs, NJ: Spectrum/Prentice-Hall, 1984. Handmade paper and alternative processes.

Sanderson, Andrew. *Hand Coloring and Alternative Processes*. Switzerland: Rotovision, 2002. Instructions on coloring, paper negatives, bromo, cyanotype, silver salt, platinum, and gum printing.

Stone, Jim. *Darkroom Dynamics: A Guide to Creative Darkroom Techniques.* Boston: Focal Press, 1979. Chapters on high-contrast negatives, Liquid Light, toning, hand-coloring by artists known for the specific technique.

Stroebel, Leslie, and Richard Zakia, eds. *The Focal Encyclopedia of Photography: Third Edition.* Boston: Focal Press, 1993. Nine hundred pages from over 90 experts describing processes from antique to digital photography, including four pages on "nonsilver processes" by Judy Natal.

Van Keuren, Sarah. *A Non-Silver Manual.* Lansdowne, PA: Sarah Van Keuren, updated 2004. Includes instructions for nonsilver processes and pinhole photography, with supply prices. Not for beginners. Available from the author at 6 Hereford Place, Lansdowne, PA 19050, or from Photo-Eye.

Wade, Kent. *Alternative Photographic Processes.* Dobbs Ferry, NY: Morgan & Morgan, 1978. Imaging on glass, metal, fabric, tile, etc. This is a hard-to-find book full of ideas and information.

Webb, Randall and Martin H. Reed. Alternative Photographic Processes. Rochester, NY: Saunders/Silver Pixel, 2000.

Specific Processes

Transfers and Lifts

Baker, Robert, and Barbara London. *Instant Projects.* Cambridge, MA: Polaroid, 1986, 1992. Handbook of demonstrations, including building pinhole and stereo cameras and making separation negatives for casein and gum printing.

Carr, Kathleen T. *Polaroid Transfers: A Complete Visual Guide to Creating Image and Emulsion Transfers.* New York: Amphoto Books, 1997.

Grey, Christopher, and Gwen Lute. *Photographer's Guide to Polaroid Transfer.* Buffalo, NY: Amherst Media, 1997.

Murray, Elizabeth. *Painterly Photography: Awakening the Artist Within.* San Francisco: Pomegranate Artbooks, 1993. Polaroid SX-70 manipulated pictures.

Polaroid Corp. *Advanced Image Transferring.* Cambridge, MA: Polaroid Corp., 1991. In the United States, call their toll free number, 800-225-1618, and ask for the free brochure. In Great Britain, try Freefone 2122. They still have offices worldwide and an active website.

Polaroid Corp. *Creative Uses for Polaroid Films.* Cambridge, MA: Polaroid Corp., 1992. Out of print.

Polaroid Corp. *Instant Innovations.* Cambridge, MA: Polaroid Corp. Out of print.

Polaroid Corp. *Polacolor Image Transferring.* Cambridge, MA: Polaroid Corp., 1990. Out of print.

Schminke, Karin, Dorothy Simpson Krause, and Bonny Pierce Lhotka. *Digital Art Studio: Techniques for Combining Inkjet Printing with Traditional Artist's Materials.* New York: Watson-Guptill Publications, 2004. Clear and useful instructions; most complete book that I know of on the subject.

Tourtillot, Suzanne. *The New Photo Crafts. Photo Transfer Techniques and Projects for Fabric, Paper, Wood, Polymer Clay, and More.* New York: Lark Books, 2001.

Toning and Hand Coloring

Airy, Theresa. *Creative Digital Printmaking.* New York: Amphoto Books, 2001. Section on hand coloring digital prints.

Anchell, Steve. *The Variable Contrast Printing Manual.* Boston: Focal Press, 1997. Explanation of reason, methods, and hints for toning plus appendix containing some recipes for mixing toners from scratch.

Davidson, Jerry. *Light Up Your Darkroom: How to Tone, Tint, and Retouch Black-and-White Prints.* Markham, Ontario, Canada: Pembroke Publishers Limited, 1986. Published with the assistance of Berg Color-Tone, Inc.

Davidson, Jerry. *From Black and White to Creative Color.* Ontario, Canada: Pembroke Publishers Limited, 1994.

Dorskind, Cheryl Machet. *The Art of Handpainting Photographs.* New York: Amphoto Books, 1998. Thorough description of subtly applying oil-based colors.

Henisch, Heinz K., and Bridget A. Henisch. *The Painted Photograph 1839–1914: Origins, Techniques, Aspirations.* University Park, PA: The Pennsylvania State University Press, 1996. Over-painting employed in daguerreotypes, tintypes, porcelain, glass, lantern slides, and textiles.

Laird, Sandra, and Carey Chambers. *Handcoloring Photographs: Step by Step.* Buffalo, NY: Amherst Media, 1997.

Mallinckrodt Chemical Works. *The Chemistry of Photography.* St. Louis, MO: Mallinckrodt Chemical Works, 1940. This wire-bound, hardcover book, which cost fifty cents then, contains 16 pages of formulae still applicable today for "changing the neutral black image to a more pleasing or more appropriate color."

Marshall, Lucille Robertson. *Photo-Oil Coloring for Fun or Profit.* Washington, DC: Larum Pub. Co., 1944. Could she be related to Marshall's photo oils?

Martin, Judy, and Annie Colbeck. *Handtinting Photographs.* Cincinnati, OH: North Light Books, 1989.

McKinnis, James. *Hand Coloring Photographs.* New York: Amphoto Books, 1994. Showcases color reproductions from many commercial artists and techniques different from mine—he recommends using colors straight out of the tube, but I say don't trust anyone else to manufacture the color you want.

McKinnis, James A. *Photo Painting, The Art of Painting on Photographs.* New York: Amphoto Books, 2002.

Newman, Richard. *Toning Techniques for Photographic Prints* Buffalo, NY: Amherst Media, 2003.

Rudman, Tim. The Photographer's Toning Book: The Definitive Guide. New York: Amphoto, 2003. Sepia, tea, and other non-commercial toners, etc.

Sanderson, Andrew. *Hand Colouring and Alternative Processes: B & W Photo Lab.* Switzerland: RotoVision SA, 2002. Instructions on coloring, paper negatives, cyanotype, silver salt, platinum, and gum.

Schaub, Grace, and George Schaub. *Marshall's Hand-Coloring Guide and Gallery: The Tools and Techniques Using Marshall's Materials.* Chicago, IL: G & G Schaub Publishers and John G. Marshall Co., a division of Brandess/Kalt/Aetna Group, Inc., 1995.

Wall, Alfred H. *A Manual of Artistic Colouring as Applied to Photographs.* Reprint of 1860 ed. P.O. Box 938, Salem, NH: Ayer Co. Pub., "A practical guide to artists and photographers" (www.ayerpub.com).

Winser, Cheryl. *The Art of Hand Coloring Photography.* Cincinnati, OH: North Light Books, 1995.

Worobiec, Tony. *Toning and Handcoloring Photographs.* New York: Amphoto Books, 2002.

Darkroom and Analogue Negatives

Anschell, Steve. *Film Developing Cookbook*. Boston: Focal Press, 1998.

Anschell, Steve. *The Darkroom Cookbook*. 2nd ed. Boston: Focal Press, 2000.

Duren, Lista, and Billy McDonald. *Build Your Own Home Darkroom.* New York: Van Nostrand Reinhold, 1982.

Eastman Kodak. *Building a Home Darkroom*. Rochester, NY: Eastman Kodak, 1996. Publication KW-14. Out of print.

Eastman Kodak. *Copying and Duplicating in Black-and-White and Color.* Rochester, NY: Eastman Kodak, 1984. Ask for (free) pamphlet #M-1.

Hearsum, Tim. *Fine-Line Developer.* Rochester, NY: Visual Studies Workshop Press, 1975.

Holter, Patra. *Photography Without a Camera, second edition.* L.I.R. Box 429, Yonkers, NY: Van Nostrand Reinhold, 1980. Great ideas for experimental photographers and teachers on a limited budget. I understand—and hope—that it is being reprinted.

Hutchings, Gordon. *The Book of Pyro.* Granite Bay, CA: Bitter Dog Press, 1992. Available from Bostick & Sullivan, this detailed manual tells all about one of the oldest developing agents treasured by large-format photographers.

Polaroid Corp. *Darkroom Techniques.* Cambridge, MA: Polaroid Corp and Instant Projects.

Seely, J. *High Contrast.* Boston: Focal Press, 1980.

Wall, E. J., and F. L. Jordan. *Photographic Facts and Formulas.* Reprint of 1940 text. Englewood Cliffs, NJ: Prentice-Hall, 1975. Tables, formulae.

Zimmerman, Philip. *Options for Color Separations: An Artist's Handbook.* Rochester, NY: Visual Studies Workshop Press, 1980. Bountiful ideas for photographers and nonphotographers for making negatives. Unfortunately, out of print.

Pinhole

Chernewski, Anita. *How-To Make Three Corrugated 8 × 10 Pinhole Cameras: Wide-angle, Normal, Telephoto.* Pinhole Format Co., 1999. Instructions and materials included.

Evans, John. *Adventures with Pinhole and Home-Made Cameras: From Tin Cans to Precision Engineering.* East Sussex, England: RotoVision, 2003. www.rotovision.com. Jesseca Ferguson says: Good overview of contemporary pinhole/eccentric cameras and the images they produce.

Renner, Eric. *Pinhole Photography: Rediscovering A Historic Technique*. 3rd ed. Boston: Focal Press, 2004. Jesseca Ferfuson says: Wonderfully comprehensive overview of pinhole photo from the editor/founder of *Pinhole Journal*; lots of pinhole photos, history, "how-to" section, etc. A must!

Shull, Jim. *The Beginner's Guide to Pinhole Photography*. Buffalo, NY: Amherst Media, Inc., 1999. This is the latest version of Shull's classic how-to pinhole book, *Hole Thing Manual*.

Shull, Jim. *The Hole Thing: A Manual of Pinhole Photography.* Dobbs Ferry, NY: Morgan & Morgan, 1974. Can purchase from www.icp.com.

Smith, Lauren. *The Visionary Pinhole*. Salt Lake City: Peregine Smith Books, 1985.

Digital Negatives

Burkholder, Dan. *Making Digital Negatives for Contact Printing*. San Antonio, TX: Bladed Iris Press, 1998. www.danburkholder.com and danphoto@aol.com.

Farace, Joe. *Digital Imaging Tips, Tools, and Techniques*. Boston: Focal Press, 1998. Includes a CD-ROM of all steps outlined in the book.

Fraser, Bruce, and David Blatner. *Real World Adobe Photoshop CS2: Industrial Strength Production Techniques.* Berkeley, CA: Peachpit Press, 2005. Recommended by Young Suk Suh, author of Chapter 6 of this book, "Making Digital Negatives."

Nelson, Mark I. *Precision Digital Negatives.* This is an electronic book that you can purchase and download at www.precisiondigitalnegatives.com.

Sesto, Carl. *Designers Guide to Digital Imaging.* New York: Wiley Computer Publishing, 1996. Impressively clear.

Cyanotype

Fabbri, Malihan, and Gary Fabbri. *Blueprint to Cyanotypes: Exploring a Historical Alternative Photographic Process*. Self published. www.alternativephotography.com/books, 2006. Malihan is the editor of the website, which contains how-to articles, chat, books, galleries by mostly European photographers, and suppliers almost world-wide.

Hewitt, Barbara. *Blueprints on Fabric*. Loveland, CO: Interveave Press, 1995. Lots of direct methods for making images. From the former owner of Blueprints-Printables, www.blueprintables.com.

Ware, Mike. *Cyanotype: The History, Science and Art of Photographic Printing in Prussian Blue*. London: Science Museum and National Museum of Photography, Film and Television, 1994. Distributed in the United States by Michigan State University Press and in the U.K. by Gazelle Book Distributors. From the chemist and practitioner who invented a new cyanotype process comes a book of history and information.

Brown Printing

Eastman Kodak. *A Sensitizer for Paper, Cloth and Similar Materials.* Rochester, NY: Eastman Kodak Co. Pamphlet AJ-5.

Stevens, Dick. *Making Kallitypes.* Boston: Focal Press, 1993.

Webb, Randall and Martin Reed. Spirits of Salt. *A Working Guide to Old Photographic Processes*. London: Argentum, 1999. Kallitypes and other techniques.

Gum Bichromate and Kwik Printing

Gassan, Arnold. *The Color Print Book.* Rochester, NY: Light Impressions Corp., 1981. Information on color separation negatives, gum bichromate, and Kwik Printing included with other subjects.

Lewis, Eleanor, ed. *Darkroom.* New York: Lustrum Press, 1977. Chapter on contemporary artist Betty Hahn and her gum prints.

Nadeau, Luis. *Gum Bichromate and Other Direct Carbon Processes.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1987.

Scopick, David. *The Gum Bichromate Book.* 2nd ed. Boston: Focal Press, 1991. Extensive instructions, including negative prep, color separation techniques, and Kwik Printing, in addition to 15 step-by-step instructions on the gum printing process.

Swedlund, Charles, and Elizabeth Swedlund. *Kwik Print.* Rochester, NY: Light Impressions Corp., 1987.

Whipple, Leyland. *The Gum Bichromate Printing Process.* Manuscript at the George Eastman House, Rochester, NY.

Wilson, Helena Chapellin. "Gum Bichromate Printing," *Darkroom Techniques* (June 1981), pp. 40–44.

Platinum/Palladium Printing

Arentz, Dick. *Platinum & Palladium Printing.* Boston: Focal Press, 2000.

Galindo, Julio. *The Platinotype*. Mexico. Spanish and English.

Nadeau, Luis. *The History and Practice of Platinum Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1994. The first printing of this revised edition in English has a tipped-in platinum print. German language edition published by Lindemanns Verlag, Stuttgart, Germany.

Rexroth, Nancy, *The Platinotype*. 2nd ed. Yellow Springs, OH: Violet Press, 1977. Available from Photographer's Formulary.

Rice, Ted. *Palladium Printing, Made Easy.* Santa Fe, NM: Eagle Eye Text Production, 1994. Detailed instructions on chemistry, negative-making, paper, processing, and finishing for palladium prints. Includes advanced palladium techniques such as toning and the use of different developers. Available only through Photo-Eye. Out of print.

Shillea, Thomas John. *Instruction Manual for the Platinum Printing Process.* Philadelphia: Eastern Light Photography Ltd., 1986. Precise instructions, carefully researched with safety data, available from Photographer's Formulary.

Sullivan, Richard S. *Labnotes.* Van Nuys, CA: Bostick and Sullivan, 1982. Readable and funny instructions on platinum, palladium, and Kallitype, plus generally helpful tips on coating, exposure calculation, brushes. From half of the Bostick & Sullivan team.

Sullivan, Richard, and Carl Weese. *The New Platinum Print.* Santa Fe, NM: Working Picture Press, 1998. www.bostick-sullivan.com. Also contains instructions for digital negatives.

Bromoil

Laughter, Gene. *Basic and Advanced Bromoil Inking* (video). Available from author at glaughter@earthlink.net, and Bostick & Sullivan.

Laughter, Gene. *Bromoil 101: A Plain English Working Manual and User's Guide for Beginners in the Bromoil Process.* Self-published, 1997. Available from http://alt-photo.com, and from Photo-Eye Books and Bostick & Sullivan, and from the author at the e-mail address above.

Lewis, David W. *The Art of Bromoil and Transfer.* Self-published, 1995. Available through Photo-Eye Books and Photographer's Formulary (see Supply Sources; out-of print, but can try www.abebooks.com).

Nadeau, Luis. *History and Practice of Oil and Bromoil Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1985. www.photoconservation.com.

Enlargement Emulsions

Eastman Kodak. *Making a Photographic Emulsion.* Rochester, NY: Pamphlet #AJ-12.

Morgan & Morgan. *The Morgan & Morgan Darkroom Book.* Dobbs Ferry, NY: Morgan & Morgan, 1980. Includes a chapter on "Liquid Light."

Reed, Martin, and Sarah Jones. *Silver Gelatin.* New York: Amphoto Books, 1996. Not a stone left unturned in this text.

Daggerotype

Sobieszek, Robert A, ed. *The Daguerreotype Process: Three Treatises, 1840–1849.* New York: Arno Press, 1973.

Alternative Color and Chromoskedasic

Neblette, C. B. *Neblette's Handbook of Photography and Reprography: Materials, Processes and Systems.* New York: Van Nostrand Reinhold, 1977. The only book I know of besides this one with instructions on chromoskedasic painting.

Related Processes

Bunnell, Peter. *Non-Silver Photographic Processes: Four Selections, 1886–1927.* New York: Arno Press, A New York Times Company, 1973. Reprint of original manuscript on photogravure, gum bichromate (by DeMachy), oil and bromoil processes, and platinotype (platinum print).

Croner, Marjorie. *Fabric Photos.* Loveland, CO: Interweave Press, 1989.

Davies, Adrian, and Fennessy, Phil. *An Introduction to Electronic Imaging for Photographers.* Boston: Focal Press, 1998. Electronic imaging in down-to-earth language. Includes copyright-free CD-ROM, playable on both Macintosh and IBM computers.

Davies, Adrian. *Focal Digital Imaging A to Z.* Boston: Focal Press, 2005. Reasonably priced paperback with over 1000 definitions and explanations. Supported by updated website.

Ephraims, Eddie. *Creative Elements: Darkroom Techniques for Landscape Photography.* New York: Amphoto Books, 1993.

Greene, Alan. *Primitive Photography: A Guide to Making Cameras, Lenses, and Calotypes.* Boston and London: Focal Press, 2002.

Hedgecoe, John. *The Photographer's Handbook.* New York: Alfred P. Knopf, 1995. A brief explanation of everything photographic from A (ambrotype) to Z (zoom lenses).

Koenig, Karl P. *Gumoil Photographic Printing.* Rev. ed. Boston: Focal Press, 1999.

Kolb, Gary P. *Photogravure: A Process Handbook.* Carbondale, IL: Southern Illinois University Press, 1986.

Laury, Jean Ray. *Imagery on Fabric.* Lafayette, CA: C&T Publishing, 1992.

Nadeau, Luis. *Modern Carbon Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1986.

Osterman, Mark. *The Wet-Plate Process, A Working Guide.* Rochester, NY: Sully & Osterman, 2002. www.collodion.org to see other publications and an impressive gallery of Osterman's and Sully's work.

Reilly, James M. *The Albumen and Salted Paper Book.* Rochester, NY: Light Impressions Corp., 1980.

Robinson, Henry Peach, and Abney Wivelesley. *The Art and Practice of Silver Printing.* New York: Arno Press, 1973. An 1881 reprint.

Sims, Ami. *Creating Scrapbook Quilts.* Flint, MI: Mallary Press, 1993.

Sobieszek, Robert A., ed. *The Collodion Process and the Ferrotype: Three Accounts, 1854–1872.* New York: Ayers Co.,1973. Reprint of 1911 text.

Towler, John. *The Silver Sunbeam.* New York: Morgan & Morgan, 1974. Textbook on sun drawing and photographic printing. Wet and dry processes, with collodion, albumen, gelatine, wax, resin, and silver.

Worobiec, Tory, Ray Spence, and Tony Worobiec. *Photo Art: In-Camera/Darkroom/Digital/Mixed Media.* New York: Amphoto Books, 2003, and London: Collins and Brown Limited, 2003. Multiple printing, infrared, toning, pinhole, scanner as camera.

Magazines and Journals

The Alternative Photo Review
Alt Press
6, Penwith Business Center
Long Rock, Penzance
Cornwall TR20 8HL
United Kingdom
Another magazine found in the archives of libraries

Camera Arts
Shine Media Group
P.O. Box 3941
Alburquerque, NM 87190
Tel: 505-881-2717
Website: www.camerarts.com
Quality reproductions, darkroom and digital articles, and equipment and product reviews, specifically aimed toward the medium and small format photographer.

Camera and Darkroom Photography
P.O. Box 271309
Escondido, CA 92027
It was good while it lasted. Your library may have old issues.

Fiberarts
201 E. Fourth St.
Loveland, CO 80537
Website: www.fiberarts.com
Tel: 970-613-4679
Geared toward artists/craftspersons, the magazine has published articles on photo-printing on fabric and related subjects.

Photo Techniques (formerly *Darkroom & Creative Camera Techniques*)
Preston Publications, Inc.
6600 West Touhy
Niles, IL 60714-4588
Website: www.phototechmag.com
Tel: 847-647-2900
Bimonthly, usually with one article related to photo-printmaking.

Test Magazine
Polaroid Corp.—see Supply Sources.

View Camera Magazine
P.O. Box 2328
Corrales, NM 87048
Website: www.viewcamars.com
Tel: 800-894-8439
"The journal of large-format photography". Pinhole included, and downloadable version for Europe, UK, and Asia. Contests, workshops.

The World Journal of Post-Factory Photography
Post Factory Press
61 Morton Street
New York, NY 10014
E-mail: editor@post-factory.org
Edited by knowledgeable, spunky, and humorous Judy Siegel. Each issue focused on a process and examined its contemporary practice, history, and abundant latest technical information. No longer printed, but you can buy past issues.

Health and Safety

If you have questions about materials you are handling, call your local Department of Public Health. Other organizations you can contact are:

The Art and Craft Materials Institute, Inc.
P.O. Box 479
Hanson, MA 02341-0479
Website: www.Acminet.org
Tel: 781-293-4100

Artists Health Education Project
c/o The Artists Foundation
Boston, MA 02110

Arts, Crafts and Theater Safety
181 Thompson Street, #23
New York, NY 10012
Attn.: Monona Rossol
Website: www.artscraftstheatersafety.org
Tel: 212-777-0062
Publishes a monthly newsletter updating health and safety issues by the co-author of the authoritative book *Overexposure*, listed below. Impeccably reliable, Monona will answer questions over the phone, but please donate to her not-for-profit organization.

Center for Safety in the Arts
5 Beekman Street
New York, NY 10038
Website: www.worldcatlibraries.org
Publishes a monthly newsletter, *Art Hazards News*, in 5 languages.

Ilford 24-Hour Emergency Response Hotline
Website: www.ilfordphoto.com
Tel: 800-888-8372 (USA)
Information in 11 European languages.

Kodak 24-Hour Hotline
Tel: 585-722-5151 or
Kodak, Ltd.
Harrow, England
Tel: 01-427-4280 (England, Europe, Africa)
Kodak publishes pamphlet # J300, *Environmental Guidelines for Amateur Photographers*, and downloadable information.

Material Safety Data Sheets (MSDS)
Website: www.msdssearch.com
Contains information on health effects of exposure and safety precautions, such as storage, handling, and emergency procedures related to a chemical product. Part of Canadian Centre for Occupational Health and Safely (CCOHS). Constantly updated.

OSHA Publications Office
Room N-3101
200 Constitution Avenue, NW
Washington, DC 20210
Website: www.osha.gov
Tel: 800-321-6742
U.S. Department of Labor, Occupational Safety and Health Administration. Spanish and English.

The following publications also instruct artists on safety issues:

Barazani, Gail Coningsby. *Safe Practices in the Arts & Crafts: A Studio Guide.* New York: The College Art Association of America, 1978.

Clark, Nancy, Thomas Cutter, and Jean-Ann McGrane. *Ventilation: A Practical Guide.* New York: Center for Occupational Hazards, 1984.

Eastman Kodak. *Safe Handling of Photographic Chemicals.* Rochester, NY: Eastman Kodak Co., 1979. Request (free) pamphlet #J-4 or *Disposal of Small Volumes of Photographic Processing Solutions* (pamphlet #J-52).

McCann, Michael. *Artist Beware.* New York: Lyons & Buford, 1992.

McCann, Michael. *Health Hazards Manual for Artists.* New York: Nick Lyons Books, 1985.

Sax, N. Irving. *Dangerous Properties of Industrial Materials.* New York: Van Nostrand Reinhold, 1975.

Shaw, Susan, and Monona Rossol. *Overexposure: Health Hazards in Photography.* 2nd ed. New York: Allworth Press, 1991. Absolutely the most thorough, well-organized book on health, safety, and legal issues about photography. Should be required reading in order to make intelligent and informed choices about your materials and procedures. In the United States, call the authors' hotline with questions: 212-777-0062.

Worker's Compensation Board. *WHMIS Core Material: A Resource Manual.* Richmond, British Columbia, Canada. An inexpensive guide to Canadian health and safety requirements.

Internet

For those of you connected to the Internet, printmaker and author Luis Nadeau recommends ALT-PHOTO-PROCESS-@VAST.UNSW.EDU.AU. He also invites written inquiries into his research center and museum, where he will in the summer open his nonsilver print collection and library to researchers. Contact Luis Nadeau, Box 7, Site 4, RR #4, Fredericton, New Brunswick, Canada, E3B 4X5 or be educated by his website, www.photoconservation.com.

Other sites include:

http://www.albumen.stanford.edu. A whole lot on the albumen process including a demonstration and literature, often out of print books.

www.alternativephotography.com for articles and how-to's, books, magazines, chat, gallery, technical information, processes, and supplies.

The Alternative Photographic Process FAQ (frequently asked questions): http://duke.usask.ca/. The FAQ includes information about subscribing to a daily exchange, sometimes with the authors of the aforementioned books: subscribealt-photo-process-1. The archives of this list are a great resource, and you may find many of your questions answered in the discussions there: http://www.webcom/gwalker/altphoto/. Some of the information is out of date.

www.bostick-sullivan.com for information in the United States about the Alternative Photographic International Symposium (APIS) and www.bostick-sullivan.com/rapp/rapp.htm for Registered Alternative Photographic Person worldwide updates and database. See kingnapoleonphoto@compuserve.com for APIS information in Europe.

http://home.earthlink.net/~trans40/hopperlist. A master list of bromoil websites on the internet may be found here.

www.cfaahp.org, Center for Alternative and Historic Processes. Workshops in New York City. No digital. Gallery online, artist talks.

www.daguerre.org. Website of the Daguerrereian Society, 3043 West Liberty Avenue, Pittsburgh, PA 15216-2460. Tel: 412-343-5525. Bi-monthly newsletter, symposium.

www.davidmichaelkennedy. Lots of info regarding alternative processes, including detailed instructions on making enlarged negatives with panchromatic film.

www.lightfactory.org. Condensed instructions on photo processes and workshops.

www.newdags.com. "Portal to the world of contemporary daguerreotypes—the people who make them and how it is done."

http://photography.about.com/od/altprocesses/. You name it and can find it on this site.

www.thelaboratorium.org. Dedicated to preserving and promoting techniques that are quickly fading into history of the arts. They create custom ambrotype portraits, curate exhibits, run workshops.

http://unblinkingeye.com. A how-to, who's-out-there, and where-do-I-find it website.

www.sfp.photographie.com. French language website, journal, group founded in 1854. "A cover image and summary of the current issue of the SFP Bulletin is available, with access to some full text articles from previous issues, dating back to 1997. The 'portfolio' section contains photographs illustrating themes, such as war photography, photography in relief, and scientific photography. The SFP holds a large photography and apparatus collection, although information about this is missing from the site. There is information about the SFP library including lists of periodicals held and works received. The site also links to the site of 'Études photographie,' published by the SFP, which contains summaries of issues and other information about this journal.

www.workingpictures.com/links/. For platinum printing information.

Some pinhole websites:

www.pinholeday.org
www.pinhole.com
www.pinholeformat.com
www.pinholephotos.com
www.pinholevisions.org/diary/events/
www.pinhole.org

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Health and Safety Products

Please refer to the Annotated Bibliography for organizations and books to assist in your selection of safety products.

Drager Sicherheitstechnik GmbH
(of Lab & Occupational Safety)
Revalstrafse 1
D-23560 Lobeck
Germany
Tel: 49 451882-0
Fax: 49 451882-2080
Website: www.draeger.com
Respirator masks and diver's neoprene gloves.

General Scientific Safety
525 Spring Garden Street
Philadelphia, PA 19123
Tel: 800-523-0166 or 215-739-7559
Fax: 215-922-5740

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
Tel: 800-356-0783
Fax: 800-543-9910
Safety tech line: 800-356-2501
Outside U.S. and Canada: 608-754-7160
Website: www.labsafety.com or www.lss.com
Over 130,000 products including gloves and ventilation. Will ship worldwide. Can order by phone, e-mail, or online.

Photo-Printmaking Products

Check www.alternativephotography.com/shop/dir_chemicals.html for suppliers in Europe, Russia, and Australia.

Adorama
42 West 18th Street
New York, NY 10011
Tel: 800-223-2500 or 212-741-0052
Fax: 212-463-7223
Website: www.adoramacamera.com
Contact (printing) frames, Fotospeed toners, Spot Pen hand coloring pen sets, Marshall Color sets, videos and books, and professional temperature controllers.

Antec, Inc.
721 Bergman Avenue
Louisville, KY 40203
Tel: 800-448-2954 or 502-636-5176
Fax: 502-635-2352
E-mail: info@kyantec.com
Website: www.kyantec.com
Special list of chemicals for alternative processes, but other needed chemicals in their regular catalog in 25 g increments.

Art Craft Chemicals
P.O. Box 382
Altamont, NY 12009
Tel: 518-355-8700
Order only: 800-682-1730
Fax: 602-488-9782
Website: www.artcarftchemicals.com
Most alternative photo chemicals, including bromoil bleaching. Prepackaged and custom kits, bulk chemicals, glyoxyl, and monthly specials. They sell a non-hazardous indicator stop bath.

Atlantis European Ltd.
7–9 Plumber's Row
London E1 1EQ
England, U.K.
Tel: 0171 377 8855
Fax: 0171 377 8850
E-mail: mail@atlantisart.co.uk
Website: www.atlantisart.co.uk
Selection of Escoda brushes, paper, and pigments for bromoil and other processes. Open 7 days a week.

Badger Graphic Sales, Inc.
1225 DeLanglade Street
Kaukauna, WI 54130
Tel: 920-766-9332
Fax: 920-766-3081
E-mail: info@badgergraphics.com
Website: www.badgergraphic.com
Liquid Light, lith film, and lith A and B developer. International shipping.

Berg Color Tone System, a division of Omega/Satter
1041 South Carroll Street
Hampstead, MD 21071
Tel: 410-374-3250
Fax: 410-374-3185
Website: www.omegasatter.com
In addition to toners, Berg makes gold protective solution, brushes, dehardener, Berg Bath, *From Black & White to Creative Color*, and retouching kits. To stock Berg products, your photo dealer should contact Omega/Satter.

Blue Sunprints (see Fabric Suppliers)
In addition to the items mentioned under Fabric Suppliers, they also sell cyanotype precoated on 90 lb. watercolor paper and very decently priced blueprint chemicals. Formerly Blue Printables.

Bob Slate Stationer
1288 Massachusetts Avenue
Cambridge, MA 02139
Tel: 617-547-1230
Website: www.bobslate.com
They sell 8 × 10 rubylith, Acco two-hole punch, and Crane's paper.

Bostick & Sullivan
P.O. Box 16639
Santa Fe, NM 87592
Tel: 505-474-0890
Fax: 505-474-2857
Website: www.bostick-sullivan.com for online catalog
They ship dry chemicals for all processes in this book, premixed kits for platinum and palladium, Pictorico OHP transparency, glass coating rods plus equipment, Mike Wares cyanotype process kit, books, and rag papers. Check out their ziatype process; kits for cyanotype, van dyke, gum and kallitype; terrific and relatively inexpensive print frames and exposure units; HOBO 5 × 7 and 8 × 10 point-and-shoot cameras, and bromoil supplies. Call them (it's a family affair) for technical advice and info regarding the yearly Alternative Photo International Symposium. There is a chat group. They are personable and knowledgeable.

Brandess-Kalt-Aetna Group, Inc
701 Corporate Woods Parkway
Vernon Hills, IL 60061
Tel: 847-821-0450
Fax: 847-821-5410
E-mail: bkaservice@bkaphoto.com
Website: www.bkaphoto.com
They are wholesalers of Premier contact printing frames, Marshall hand-coloring products and Extra Strong Colors, Retouch Method toners, Rockland Liquid Light, Rockland Halo-chrome silver toner, Rockland Blue Print, digital canvas, and darkroom apparatus. Ask your camera store to order from them.

Bryant Laboratory, Inc.
1101 Fifth Street
Berkeley, CA 94710
Tel: 800-367-3141 or 510-526-3141
Fax: 510-528-2948
Website: www.bryantlaboratory.com
They will ship small or large quantities of decently priced chemicals within the United States.

Buckaroo's Mercantile
5 Brookline Street
Cambridge, MA 02139
Tel: 617-492-4792
Website: www.buckmerc.com
They sell colorful Mexican oil cloth by the yard—it's wipeable and great for covering, and aprons too. You can almost feel that Mexican sun when you see the cloth! Their website is hilarious.

Bulb Direct
1 Fishers Road
Pittsford, NY 14534
Tel: 800-772-5267
Fax: 800-257-0760
Website: www.bulbdirect.com
Specialized lamp supplier. They have blacklight fluorescent tubes.

Calumet
890 Supreme Drive
Bensenville, IL 60106 and other locations
Tel: 800-225-8638
Fax: 800-577-3686
International Tel: 630-860-7447
International Fax: 630-860-7105
Website: www.calumetphoto.com
Cachet Black Magic, Rockland Liquid Light, toners, color photo pens, Marshall's oils and pencils, the Marshall Sampler Kit, Marshall's hand-coloring media for inkjet printers, Luminos digital papers, nonsilver kits. NPC Polaroid film back for 35 mm and 2¼ cameras, The Polaroid Holga, special bucket for clearing Polaroid negatives, Polaroid supplies, Daylab and accessory film bases for Daylab, Polaroid Emulsion/image transfer kit. Kathleen Carr's book *Polaroid Manipulations*, this book, rag digital papers.

Camera Lucida Company
Roger Vaughn
7 Bexley Court
Reading RG30 2DY
Great Britain
Tel: 0118-959-6704
E-mail: info@camaeralucida.org.uk
Website: www.cameralucida.org.uk
Carefully manufactured portable device, based on the ones used by Fox Talbot and other founders of photography to enable them to draw. This is the device that David Hockney theorizes was used by Ingres, Warhol, and others. Can use outdoors, with studio setups and with photographs.

Canson-Talens, Inc.
21 Industrial Drive
South Hadley, MA 01075
Tel: 800-628-9283
Website: www.canson-us.com
U.S. distributor of Platine paper.

Chicago Albumen Works
P.O. Box 805
174 Front Street
Housatonic, MA 01236
Tel: 413-274-6901
Fax: 413-274-6934
Website: www.albumenworks.com
Printing out paper and enlarged negatives for contact printing.

Creative Monochrome Ltd./ISCM
Courtney House 62, Jarvis Road
South Croydon, Surrey CR2 6HU
U.K.
Tel: 0181 686 3282
Fax: 0181 681 0662
E-mail: roger@cremono.demon.co.uk
CMDirect-Fotospeed Alt Kits, replacement bromoil inks and brushes, Laughter's *Bromoil 101*, general photographic supplies.

D. F. Goldsmith Chemical & Metal Corp.
909-A Pitner Ave.
Evanston, IL 60202
Tel: 847-869-7800 (collect calls accepted)
Fax: 847-869-2531
E-mail: goldchem@aol.com
Website: www.dfgoldsmith.com
The least-expensive source I know of for silver nitrate; $50 minimum order required.

Eastman Kodak Co.
343 State Street
Rochester, NY
Website: www.kodak.com
Manufacturer of film, chemicals, and other photography and digital products. Limited how-to books such as *Advanced Black-and-White Photography* (includes hand-coloring section) by their distributor, Tiffen Photo—you may contact them at 800-645-2522.

Edwards Engineered Products
5304 Arrowhead Drive
Lago Vista, TX 78645-5803
Tel: 512-267-4274
Fax: 512-716-1914
Website: www.eepjon.com
Ultraviolet light sources, coating tubes, and even mechanical tray agitators.

Falkiner Fine Papers
76 Southampton Row
London WC1B 4AR
England, U.K.
Tel: 44 020 7831 1151
Fax: 44 020 7430 1248

Firstcall Photographic Limited
Cherry Grove Rise
West Monkton, Taunton
Somerset TA2 8LW
United Kingdom
Tel: 44 01823 4123 413007
Fax: 44 01823 413103
E-mail: sales@firstcall-photographic.co.uk
Website: www.firstcall-photographic.co.uk
Fotospeed, Rockland First Call, Alt. Process kits, darkroom and digital equipment. Shipping within 24 hours of receiving order. Discount cameras, printing-out paper, digital inkjet paper for T-shirt transfers. Kentmere digital transparency film for contact printing.

Foto Europa
7 Ave, 3-49 Zona 1
Guatemala City, Guatemala
Tel: 22 518 344
6 Ave. 9-35 Zona 10
Guatemala City, Guatemala
Tel: 23 320 118 and 119
Fax: 22 539473 and 22 321780
E-mail: fotoeuropa@terra.com.gt
They carry the requisite chemicals for black-and-white, color, and some alternate processes, such as cyanotype.

Fotospeed
6b Park Lane Industrial Estate
Park Lane, Corsham
Wilts SN13 9LG
England, U.K.
Tel: 01249 714333
Fax: 01249 714000
Website: www.fotospeed.com
Alternative process supplies including their own excellent enlargement emulsion, black-and-white chemicals and papers, coating rods, contact printing frames.

Freestyle Photographic Supplies (formerly Freestyle Sales)
5124 Sunset Boulevard
Los Angeles, CA 90027
Tel: 323-660-3460 (international)
800-292-6137 (within North America)
Fax: 800-616-3686
Website: www.freestylecamera.com
They ship UPS postage free (in continental 48 states), a less-expensive lith film, such as Aristatone, under their own label, plus enlargement emulsions, darkroom supplies, photo-offset plates, nonsilver kits, pinhole cameras, pinhole photography kits, Arista mural paper, Kentmere paper, Maco Genius supplies, and Marshall hand-coloring materials. Ask for their Alternative Process, Printmaking, Photography catalog at catalog@freestylecamera.com and information at info@freestylecamera.com.

Graphic Chemical and Ink Co.
728 North Yale Avenue
Villa Park IL 60181
Tel: 800-465-7382
Fax: 630-832-6064
Website: www.graphicchemical.com
Online catalog with bromoil supplies.

W. B. Hunt Co., Inc.
100 Main Street
Melrose, MA 02176
Tel: 781-662-8822
Mail order: 800-924-8682
Fax: 781-662-6524
Website: www.huntsphotoandvideo.com
Books, Polaroid materials, Marshall's hand-coloring supplies, black-and-white darkroom chemicals, brushes, N.P.C. Polaroid camera backs for 35 mm and 2/ cameras, kits from Photographer's Formulary, Open seven days a week. Free catalog. Will ship within the United States.

Hunter Penrose Ltd.
32, Southwark Street
London SE1 1TU
United Kingdom
Tel: 0171 407 5051
Fax: 0171 378 1800
Printmaking supplies for bromoil.

IlFord/Harmon Technology Ltd.
Tel: 44 020 8504 3389 in the UK
E-mail: ilfordphoto.press@swcmedia.co.uk
Tel: 800-464-9648 in the US
E-mail: rod.parsons@harmontechnology.com
Website: www.ilfordphoto.com
They are "passionate" about black-and-white and intend to continue manufacturing fiber-based and resin-coated paper, supplying filters, film, chemicals, and digital papers.

Imperial Plating Co.
7030 W. 60th Street
Chicago, IL 60638
Tel. 773-586-3500
Fax: 773-229-0962
I have not used them, but they coat plates for daguerreotypes.

InkAID
Tel: 888-424-8167 (24 hours, orders only)
315-786-4094 (outside the U.S.)
Fax: 315-782-7771 (prefer orders by fax)
Website: www.inkaid.com
Iridescent metallic, white, and clear precoat and inks to prepare and print digital images on 3D surfaces, aluminum, wood, paper, acrylic, and almost any receptor you can feed through an inkjet printer. Makes my head spin with ideas. Also, lenticular devices to make still images appear animated! Also available at Charrette's and Daniel Smith in the U.S.

Intaglio Printmakers
62, Southwark Bridge Rd.
London SE1 OAS
U.K.
Tel: 0171 928 2633
Fax: 0171 928 2711
Website: www.intaglioprintmaker.com
Litho inks, paper, etching presses for bromoil.

International Center for Photography
1133 Avenue of the Americas
New York, NY 10036
Tel: 800-688-8171
Fax: 212-764-6422
Website: www.icp.org
They sell "Hole-On Ex Make & Shoot Pinhole Camera Kit" for constructing a cardboard camera and "Flights of Fancy," a kit for making a wooden pinhole camera.

Italian Art Store
84 Maple Avenue
Morristown, NJ 07960
Tel: 800-643-6440
Fax: 973-644-5074
Website: www.italianartstore.bizland.com
Jumbo sash brushes for bromoil.

J and C Photo
11936 West 119th Street, #263
Overland Park, KS 66213
Tel: 800-770-1769 (U.S.)
Tel: 919-783-4133 (Elsewhere)
Fax: 702-920-8826
Website: jandcphoto.com
Specializes in hard-to-find black-and-white photo products. Source for Efke PL 100 M black-and-white sheet film. Also stocks centennial printing-out paper, Adox liquid emulsion, flash bulbs (!), classic bromoil paper. Ships worldwide. No minimum.

Jay House Ltd.
Fiveways House
Rudloe, Corsham
Wilts SN13 9RG
U.K.
Tel: 01225-810596
Fax: 01225-811801
E-mail: Fotospeed_U.K@compuserve.com
Website: www.fotospeed.com
Fotospeed products, van dyke, cyanotype, bromoil, gum, palladium, and platinum kits, and photo linen.

Johnson Matthey PLC
Orchard Rd.
Royston Herts SG8 5HE
U.K.
Tel: 01763-44161
Website: www.matthey.com
Chemical supplier (industrial). Chemicals sold in standard packaging and larger quantities.

Kentmere
Steveley, Kendale
Cumbria LA89PB
U.K.
Tel: 01 539822322
Website: www.kentmere.co.uk
Kentmere sells terrific bromoil inks, brushes, chemistry as a kit, inkjet paper, and alternative process kits. Carries Centennial Printing-Out Paper. Distributor of fine black-and-white papers. Look up other agents on website for dealers in the United States, U.K., Canada, South America, China, Japan, etc.

Lambert Co., Inc.
1400 Providence Highway
Building III, Suite 3000
Norwood, MA 02062
Tel: 781-440-0842/800-292-2900
Fax: 781-440-0874
Website: www.martinsignandscreen.com
They will ship NazDar transparent base number 5530 for solvent transfers and other art materials within the United States. They sell ultraviolet exposure units, masking sheets, rubylith tape, and lint-free Webril pads.

Lazertran LLC.
1501 West Copens Road, Suite 101
Pompano Beach, FL 33064
Tel: 800 245 7547
Fax: 954 578 7300
E-mail: lazertran@d2fi.com
Website: www.lazertran.com
Dorothy Imagire says: "They are a wonderful company with several different products, including Lazertran Inkjet, Lazertran Silk, Lazertran Etch, Lazertran Inkjet textile Transfer paper for white cloth and Lazertran Inkjet textile Transfer paper for dark cloth, and psychedelic Inkjet colors."

T.N. Lawrence & Son Ltd.
208 Portland Road
Hove BN 35QT
U.K.
Tel: 0845-644-3232 (order line)
Fax: 0845-644-3233
Website: www.lawrence.co.uk
Suppliers for artists/printmakers: lith inks, rollers, brushes, Lazertran, watercolors, and papers. Other store in Cornwall.

David W. Lewis
457 King Street
P.O. Box 254
Callender, Ontario POH 1HO
Canada
Tel: 705-752-3029
E-mail: dlewis@onlink.net
More than ample choices of oil bromoil brushes, color pigments, chemicals, bromoil papers and transfer presses, as well as *The Art of Bromoil and Transfer* (see Annotated Bibliography).

Light Impressions Corp.
439 Monroe Avenue
P.O. Box 940
Rochester, NY 14603-0940
Tel: 800-828-6216
Fax: 800-828-5539
Website: www.lightimpressionsdirect.com
They carry color-spotting pens, and conservation/interleafing papers, as well as archival storage boxes.

TheMagicTouch
(International Sales and Supplies)
Benzstrasse 17
64807 Dieburg
Germany
Tel: 49 6071 921 800
Fax: 49 6071 921 821
E-mail: markus@themagictouch.com
Website: www.themagictouch.com
You can purchase transfer sheets that use color and black-and-white copying technology to relocate imagery on paper, fabric, ceramics, wood, metal, and glass. They also sell heat-press equipment, mugs, and (of course—they are in Germany) steins. Distributors in many countries.

McManus and Morgan
2506 West Seventh Street
Los Angeles, CA 90057
Tel: 213-387-2717
Web: www.mcmanusandmorgan.com
An art store that specializes in papers—thousands to choose from.

Metal Finishing Technologies
60 Wooster Court
Forestville, CT 06010
Tel: 860-582-9517
Fax: 860-584-8472
I have not used them, but they coat plates for daguerreotypes.

New York Central
62 3rd Avenue
New York, NY 1003
Tel: 212-473-7705
(800) 950-6111 (orders)
Fax: 212-475-2513 (24 hours)
E-mail: sales@newyorkcentralart.com
Website: www.newyorkcentralart.com
Wide assortment of paper including thin papers to print on, such as interleafing and air-mail stationery (great for detail).

William Paul & Associates, Ltd.
27 Holland Avenue
White Plains, NY 10603
Tel: 800-962-4050/914-761-0010
Fax: 914-761-0508
E-mail: wmpaulltd.@aol.com
Website: www.wmpaul.com
One of the largest mail-order suppliers of discount ortho film, including duplicating film for enlargers and graphic arts film; they have specials every month. Be insistent if a sales representative does not know what you are referring to—the owner does!

Pearl Paint
308 Canal Street
New York, NY 10013 (and other locations)
Tel: 212-431-7932 (international)
800-221-6845 (U.S.)
Website: www.pearlpaint.com
Seems like endless aisles of almost any marking tool (including Marshall's), paper (including discount prices on Platine, Rives, d'Arches), brushes, and watercolors. Windsor Newton gum Arabic. Stores are on the east coast of the United States.

Peerless Color Laboratory
11 Diamond Place
Rochester, NY 14609
Tel: 716-288-7460
Fax: 716-288-3854
E-mail: kbaron@eznet.net
Website: www.peerlesscolor.com
Manufacturer of Nicholson's Peerless Transparent Water Colors in sheet and liquid form for over 115 years. They produce a Complete Edition Book with 15 color sheets or the Trial Edition Book with the same 15 colors in smaller sheets. Individual sheets and liquids are available in over 200 different colors.

Philben Lithographic Supply Inc.
207 West 25th Street
New York, NY 10001
Tel: 800-274-4523
212-255-7820
Fax: 212-463-8563
Website: www.philben.com
Gum Arabic recommended by gum printer extraordinaire, Judy Seigel. Must fax or send order form.

The Photographer's Formulary, Inc.
P.O. Box 950
Condon, MT 59826
Tel: 800-922-5255
Fax: 406-754-2896
E-mail: formulary@montana.com
Website: www.photoformulary.com
They supply small or large quantities of numerous chemicals plus instructions explaining principles and theories for alternate photo processes, as well as black-and-white and color photography. Bromoil paper and Gene Laughter's bromoil video. Also, some books and apparatus (beakers, thermometers, etc.). Now they stock a version of Rodinol film developer. Monthly specials, gum arabic. The most reliable source I know of for all the light-sensitive technique chemicals, they also run summer workshops (www.workshopsinmontana.com) for black-and-white and many of the processes in this book (including my "Cyanotypes & Artists' Books" during the summer) in an area of Montana "boasting some of the best wilderness lands in the Rocky Mountains." Only ships within the United States.

Pictorico USA Inc.
c/o AGC Chemicals Americas, Inc.
229 East 22nd Street
Bayonne, NJ 07002
Tel: 888-879-8592
Website: www.pictorico.com

Inkjet transparency film for digital negatives.
Bill Szyper
National Brand Manager, mainly deals with wide format rolls/proofing.
E-mail: bszyper@agcchem.com
Yoshie Yazawa
Overseas Sales Manager
E-mail: yoshie-yazawa@agc.co.jp
Ichibancho Chuo Building 3rd Floor
4–6 Ichiban-cho, Chiyoda-ku
Tokyo 102-0082
Japan
Tel: 81-3-5212-7753
Website: www.pictorico.co.jp
Manufactures OHP for making digital negatives.

Pinhole Resource
Eric Renner
Star Route 15, Box 1355
San Lorenzo, NM 88041
Tel: 505-536-9942;
Website: www.pinholeresource.com
Pinhole Resource sells books, catalogs, pinhole cameras (many of which are hand-made), zone plate shutters, books, including Renner's own big pinhole book). *Pinhole Journal* (a fascinating publication devoted to pinhole photography around the world) is published three times a year by Pinhole Resource. Workshops.

Platinum Press
20 Maplewood Lane
Madison, CT 06443
Tel: 203-245-7674
Website: www.platinumpress.net
They sell Platine paper, custom-built exposure units, and coating tubes. Owner Martin Axon (who is a master Platinum printer) will give technical backup to customers and make custom prints.

Polaroid Corp.
Tel: 800-343-5000 (U.S.); 800-01-0119 (U.K.)
Website: www.polaroid.com
Creative website with technical advice and ordering capabilities. They sell kits for image transfers and emulsions lifts, as well as Polaroid pinhole cameras.

Porter's Camera Store, Inc.
P.O. Box 628
Cedar Falls, IA 50613
Tel: 800-553-2001
Website: www.porters.com
They sell Porter's U-Spread Photographic Emulsion in 8 oz (236 ml) bottles and Liquid Light in 16 oz (472 ml) bottles, measuring cups, Kodak and Berg and Edwal toners, Marshall's colors, Prisma Color pencils, Rockland fabric sensitizer, and a complete darkroom selection, including excellent choices of safelights. Write for their free (in the United States) catalog.

John Purcell Paper
15, Rumsey Rd.
London SW9 0TR
U.K.
Tel: 0171 737 5199
Fax: 0171 737 6765
Website: www.johnpurcell.net
Fine selection of artists' papers.

Quality Plating Co.
420 S. 500 West
Salt Lake City, UT 84101-2208
Tel: 801-355-7424
Fax: 355-7820
Website: www.qualityplating.com
They have been "plating with pride since 1955," but I have never used them for daguerreotypes.

Recognition Systems
30 Harbor Park Drive
Port Washington, NY 11050
Tel: 516-625-5000
Fax: 516-625-2538
E-mail: johnf@dotworks.com
Website: www.dotworks.com
These are the nicest folks, who still do business with personal attention. They sell opaque black bags, gum Arabic, rubylith and amberlith acetate, AFM Transparent white ink. Their main office is in England.

Retro Photographic Ltd.
Wanstead
Alchester Road
Chesterton OX26 1UN
U.K.
Tel: 440-1869-240345
Fax: 440-7970-737013
E-mail: info@retrophotographic.com
Website: www.retrophotographic.com
Specializes in black-and-white photo; maco Genus and N. P. ortho-film, printing-out paper, Kentmere and Bromoil papers, chemicals, pinhole cameras, bargain items.

Mike Robinson
245 Carlaw Avenue, Suite 502
Toronto, Ontario M8M251
Canada
E-mail: mike@centurydarkroom.com
Website: www.centurydarkroom.com
All things daguerrean: sensitizing boxes, gilding and polishing stands, coated plates. He is the one the pros seem to turn to.

Rockland Colloid Corp.
P.O. Box 376
302 Piermont Avenue
Piermont, NY 10968
Tel: 845-359-5559
Fax: 845-365-6663
Website: www.rockaloid.com
Makes trusty Liquid Light, platinotype and blueprint kits, brown print fabric and paper sensitizer, toners from pastel to metallic, colorants, inkjet transparency film, tintype kits, wet transfer paper, toner for firing photo images on ceramics, Select-a-Color photo-resists for permanent color prints on sheet metal, ceramics, illustration board and wood. As far as I know, they were the first to make enlargement emulsions.

Salis International
P.O. Box 3543
New Hyde Park, NY 10040
Website: www.docmartins.com
Distributor of Martin's Synchromatic Transparent Water Colors.

Silverprint
12 Valentine Place
London SE1 8QH
United Kingdom
Tel: 071-620-0844
Fax: 071-620-0129
Website: www.silverprint.co.uk
Materials and equipment for platinum/palladium, salted paper, gum bichromate, etc. Will supply chemistry in small quantities. Some high-quality black-and-white papers, bromoil materials. Centennial printing-out paper, toners. Very reasonably priced silver nitrate for brown printing. Specialty films, like Maco Genius and pinhole supplies. Also carry *Silver of Salts* book.

Daniel Smith
4120 1st Avenue South
P.O. Box 84268
Seattle, WA 98124
Tel: 800-426-7923 (customer service)
800-426-6740 (sales)
206-223-9599 (international)
Fax: 800-238-4065
201-224-0404 (international)
Website: www.danielsmith.com
Masking liquid, broad selection of papers, paints, Hake and other brushes, gum arabic, and photo-etching zinc plates. Also carries inks, brayers, and ink modifiers for making bromoil prints, as well as soft pastels for finishing them. Stocks InkAID for applying digital imagery to all kinds of surfaces. Will ship.

John Jones Stroud
Green Road, Finsbury Park
London N4 3JG
United Kingdom
Tel: 0171 281 5439
Fax: 0171 281 5956
Art supplies, collection of Escoda brushes for bromoil.

Team Plastics
Tel: 800-931-8326
Fax: 216-251-7341
Ask for their laser acetate overhead transparent .004 polyester film (i.e., copier film) to make transparencies on your laser printer after you check with the manufacturer.

Theiss Plating
9314 Manchester Road
St. Louis, MO

Tel: 314-961-0600
Advertisement website: www.dashinet.com/plating/stlouis/theissplating/theissplating.html. They sell one-sided, silver-plated plates for daguerreotyping. They can be a bit slow in shipping orders and inconsistent in the base thickness.

Theta Plating
3330 Princeton Drive, NE
Albuquerque, NM
Tel: 505-880-1856
Will coat silver onto worn daguerreotype plates.

Universal Light Source
1553 Folsom Street
San Francisco, CA 94101
Tel: 415-864-2880
Decent prices on Super Actinic 420 nm bulbs, which some photographers recommend for much faster and slightly more contrast (cleaner high values) exposures with platinum/palladium.

Van Son of America
Union and Liberty Streets
Mineola, NY 11501
Tel: 800-645-4182
Fax: 800-442-8744
Website: www.vansoninc.com
Manufacturer of gum arabic.

The Vermont Country Store
P.O. Box 3000
Manchester Center, VT 05255-3000
Tel: 802-362-8440
Fax: 802-362-0285
Website: www.vermontcountrystore.com
They sell modern-day oilcloth, "still easy to wipe clean and won't crack," citrus solvent, which works for solvent transfers. Typewriters, K2R Spotlifter, wooden stick cotton-tip swabs for hand-coloring, and Vesta iron on decal material.

Vesta-Inkjet Paper
c/o Econo Commerce
27 Holland Avenue
White Plains, NY 10603
Tel: 914-761-0365
Fax: 914-761-0508
E-mail: vesta_inkjetpaper@econocommerce.com
Website: www.vesta-inkjetpaper.com
Iron-on transfer materials for inkjet printers.

View Camera Store (formerly Darkroom Innovations)
P.O. Box 19450
Fountain Hills AZ 85269-9450
Tel: 480-767-7105
Fax: 480-767-7106
Website: www.viewcamerastore.com
They sell the BTZS line, including developing tubes that save on chemistry for ortho film development. [AU1]

Vintage Image
6, Penwith Business Centre, Long Rock
Penzance, Cornwall TR18 2TD
U.K.
Tel: 0176 330200
Fax: 01736 352011
Platinum/palladium printing kits with instructions, ready-mixed chemistry, including bromoil, and small quantities of raw chemistry. They print "The Alternative Photo Review."

Williams-Sonoma
Website: www.williams-sonoma.com
Located in many large-city shopping malls in the United States, they carry basting and pastry brushes good for bromoil and other processes.

Fabric Suppliers

Blue Sunprints (was Blue Printables)
P.O. Box 13066
Vashon Island, WA 98013
Tel: 800-894-9410
Fax: 206-463-2530

E-mail: info@bluesunprints.com
Website: www.bluesunprints.com and www.blueprintables.com
Fabric artist Linda Stemer and partner Susan McKeever market and ship worldwide precoated pieces of cyanotype fabric, treated fabric by the yard, and adult and youth T-shirts pretreated with cyanotype. They will preshrink and precoat paper and fabric on which you make the imagery. Also sell bulk cyanotype chemicals. You can purchase Barbara Hewitt's *Blueprints on Fabric* (see Annotated Bibliography) at a discount price, nature print transparencies (beetles, rhinos, lizards, dinos, etc.), and untreated fabric from their company. Recently, they have started selling pre-coated organza. Wholesale prices for stores, groups, and schools.

Fabrics To Dye For
1 Charlestown Beach Road
Charlestown, RI 02813
Tel: 888-322-1319
Fax: 401-364-3215
Website: www.fabricstodyefor.com
They sell Setacolor light-sensitive dyes at a 40% discount; books, notions, dye powders, and auxiliaries at 25–75% off, and prepared for dying fabrics, as well as hand-painted fabrics.

Pro Chemical and Dye Co., Inc.
P.O. Box 14
Somerset, MA 02726
Tel: 800-2-BUY-DYE (228-9393)
Fax: 508-676-3980
E-mail: promail@prochemical.com
Website: www.prochemical.com
They ship Pebeo fabric pens and natural fabric dyes and thickener to prevent dyes from bleeding, which allows for more control when hand coloring. They carry Setacolor Transparent Dyes for sun printing, respirators, tough gloves, scales.

Rockland Colloid Corp.
P.O. Box 376
302 Piermont Avenue
Piermont, NY 10968
Tel: 845-359-5559
Fax: 845-365-6663
Website: www.rockaloid.com
They make a special fabric sensitizer and inkjet transfer paper. Rockland is also listed under Photo-Printmaking products.

Testfabrics, Inc.
P.O. Box 26
415 Delaware Avenue
West Pittston, PA 18643
Tel: 570-603-0432
Fax: 570-603-0433
E-mail: testfabrics@aol.com
Website: www.testfabrics.com
Wholesale prices on desized, scoured, and prepared for dyeing fabrics and fabric swatch booklets to individuals. Unsized 100% cotton, silk, and linen by the yard, tablecloths, T-shirts, scarves, dust bunnies (?!), accessories related to costumes, translucent thread. On occasion they sell cotton seconds on an "as is" basis.

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Equivalent Imperial and Metric Measurements

Solid Measures

U.S. and Imperial Measures		Metric Measures
ounces	pounds	grams
1		28
2		28
3½		100
4	¼	112
5		140
6		168
8	½	225
9		250
12	¾	340
16	1	450
18		500
20	1¼	560
24	1½	675
27		750
28	1¾	780
32	2	900
36	2¼	1000
40	2½	1100

Liquid Measures

Fluid ounces	U.S.	Imperial	Milliliters
¼	1 teaspoon	1 teaspoon	5
¼	2 teaspoons	1 dessertspoon	10
1	1 tablespoon	1 tablespoon	14
1	2 tablespoons	2 tablespoons	28
2	¼ cup	4 tablespoons	56
4	½ cup		110
5		¼ pint or 1 gill	140
6	¾ cup		170
8	1 cup		225
9			250
10	1¼ cups	½ pint	280
12	1½ cups		340
15		¾ pint	420
16	2 cups		450
18	2¼ cups		500
20	2½ cups	1 pint	560
24	3 cups		675
25		1¼ pints	700
27	3½ cups		750
30	3¾ cups	1½ pints	840
32	4 cups or 1 quart		900
35		1¾ pints	980
36	4½ cups		1000

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Glossary

agitate: Constant rocking motion of materials in liquids to ensure even coverage.

aperture: The opening in a lens that adjusts and controls the amount of light allowed to pass through to the lens. Usually described as an *f/stop* or *f/number*.

analogue: The visuals we are used to in a nondigital environment, which actually comes from a stream of continuously variable data in the form of light energy, with variation being represented by varying quantities of luminosity. An analog image is made up of some sort of marks on film or paper that collectively create the picture you see.[1]

archival: Having a quality of maximum permanence.

banding: Interruption of graduated shades caused by the loss of tonal data. Appears as a distinct line between two tones.

binary: A computer machine language that depicts letters, numbers, and symbols as sequences of the two digits 0 and 1, or as sequences of "off" and "on." The numbers symbols are indicators not actual numbers that turn on or off little switches. This 0-1 unit is called a *bit*, which is a reduction from the phrase BInary digIT. Digit gives us the term *digital*, and 8 bits = 1 byte, from which terms like *megabyte* and *kilobyte* come.

bit: See *binary*.

blow up: To make an enlargement.

bracketing: Purposely shooting a camera exposure correctly, then overexposing one shot and underexposing another shot.

burning or **burning in:** Giving more light than the normal exposure to a selected area of the emulsion by shielding most of the emulsion from light. Burning usually makes that area darker; the technique often is used to retain more detail in the highlights. Burning is handled in the opposite manner when using duplicating film, but the highlight results are the same in the print.

clipping: Highlight and shadow values that have gone completely black or completely white, losing detail.

camera obscura: Latin for "dark room" and used by some Renaissance painters. An outside scene would be projected through a small hole in the wall of a room onto the opposite (white) wall and would appear inverted. Evolved into a smaller, portable, darkened box that used a lens, mirror, and/or ground glass to aid in drawing and, eventually, in early photography.

capture: Act of taking and saving a picture digitally.

color management: A control for getting consistent and accurate matches from your input device (scanner, camera) to your computer monitor to your output device (printer).

color separation: The process of dividing full-color originals into the primary process printing colors: magenta, yellow, and cyan.

contact frame: See *print frame*.

contact print: A photographic image made from a negative or positive placed on the surface of sensitized paper, film, or printing plate, and exposed to light.

continuous-tone: An image containing gradient values as well as black-and-white.

contrast: Differences in tones in a picture.

copy: (1) Any furnished material or artwork to be used in printing; (2) in typography, written rather than visual image; (3) in electrographics, an interpretive print or reproduction.

correct reading: Facing the same direction as the original.

curves: Graphs in digital image software showing how input is related to output.

daguerreotype: First successful photographic process introduced publicly (1839). The image was exposed directly through a camera onto a polished silver plate.

darkroom: A light-tight area, either completely dark or specially illuminated, for handling light-sensitive materials.

dense negative: A reversed-tone transparency so dark that it transmits very little light.

density: Measure of opacity of an image. The emulsion buildup in a negative or positive. The greater the exposure to light and the longer the developing time, the more solid the density.

developer: A solution rendering latent images visible after exposure.

digital: Electronic data representing information as numbers, based on discrete binary digits, for processing by a computer. See also *binary*.

digital imaging: Using computer devices and processes for producing pictures.

[1] Sesto, Carl. *The Macintosh Designer's Guide to Digital Imaging*. New York: Wiley Computer Publishing, 1996.

dimensional stability: The quality in a support of not changing its size by shrinking or stretching.

dodging: Holding back some light on an area of the emulsion during an exposure. Dodging usually renders that area lighter and often is used to retain more detail in the shadows. Dodging is handled in the opposite manner with duplicating film, but the shadow results are the same in the print.

duplicating film: Film that does not reverse the image but repeats it negative-to-negative or positive-to-positive. See *film.*

easel: The device, usually a metal frame, for holding light-sensitive materials flat under the enlarger during an exposure.

electrographics: The use of copy machines, such as Xerox™, to generate art.

emulsion: A light-sensitive coating on film or paper.

enlarger: Equipment for projecting small transparencies to larger formats in a darkroom.

exposure: Subjection of a photo-sensitive coating to the action of light.

exposure unit: The source or system used to shine the appropriate light onto photosensitive emulsion.

eyeballing: Judging registration or exposure of images by visual inspection.

ferric: Substance that contains iron.

file format: Basic structural database with instructions on how to encode, save, and extract electronic information in a file. May include, for example, RAW, JPEG, TIFF, and EPS.

film: A light-sensitive material on a clear base.

fixer: A solution that removes unexposed silver halides (light-sensitive metallic compounds) from the emulsion and makes the image stable and impervious to white light. The amount of time the emulsion spends in the fixer is called the *clearing time.* Fixer is also known as *hypo.*

flat: The sheet of stripped-in negatives used to expose a photo-sensitive surface underneath. Also, a term used to describe an image without much contrast.

flatbed scanner: Optical tabletop device in which flat analog art is held level on a glass platen much like an office copier while a sensor passes over or under it and converts it into digital information. The image then can be manipulated on a computer. Shows little, if any depth. Can be purchased with an attachment for scanning transparencies.

fog: Density in the negative or print caused by errant light or chemical action not related to the normal formation of the image. See *safelight.*

f/stop or **f/number:** Fixed sizes or settings for lens apertures.

gelatin: A binder made from animal parts used as a support for the light-sensitive particles in certain emulsions.

generation: Each succeeding stage in reproduction from the original.

grain: (1) The direction in which most fibers lie in paper; (2) silver particles on film and paper, not usually visible unless viewed under magnification.

graphic arts film: A variety of orthochromatic films.

gray scale: A strip of standard gray tones ranging from black to white, used to measure tonal range and contrast. Also called a *steptable.*

hardware: All the components of a computer system except the programmed instructions (software).

heliography: An obsolete term for printing processes that depend on the sun (or ultraviolet light).

high contrast: An image or process that yields only black and white, or shadow and highlight.

highlight or **high key:** The brightest light accents in the subject. Therefore, the lightest or whitest parts in the positive and the darkest areas of a film negative.

histogram: Digital graph showing how a complete array of values in an image are distributed. The height of the graph represents the number of pixels, or picture elements, in the image at any particular value.

hypo: An abbreviation of the obsolete term for the chemical sodium thiosulfate (hyposulfite of soda) used to fix the image on some photo emulsions after development. The term also refers to the baths compounded with it. See *fixer.*

input: All methods of obtaining information into a computer, such as a scanner or digital camera.

interpolation: See *resampling.*

ISO: A number assigned by the International Standards Organization, which indicates film speed or its equivalent camera sensitivity to light. Used to be known as ASA for the American Standards Association.

laser printer: An apparatus used to transfer type and graphics from a computer onto a substrate ("hard copy"). Very strong light waves first draw the image, in the form of high-resolution dot patterns, onto a metal drum in the printer, which then electrostatically attracts dry ink powder to itself, in much the same manner as an office copier.

latent image: The invisible representation in the emulsion after exposure, later made visible by development.

layout: Drawing or sketch of proposed printed piece.

levels: One of the Adobe Photoshop® correction tools to modify the distribution of tones in an image.

light table: Equipment used for viewing and preparing transparencies, consisting of a translucent glass or plastic top with lights behind that shine through to illuminate the surface.

line: Processes and images that comprise black and white without intermediate gray tones.

line shot: High-contrast reproduction of original material.

lith or **litho film:** Also known as *ortho* film because it is not sensitive to red light waves and is commonly employed in photolithography.

loupe: Magnifier for checking image details.

low key: Shadow or dark values.

mask: Opaque material used to cover selected image areas during the exposure.

mercerized: Treatment under tension with caustic soda to give cotton cloth more strength and receptiveness to dyes.

middle tones: Shades between highlights and shadows.

negative: (1) An image in which the values of the original are reversed (usually on film); (2) a process in which the tones are reversed.

noise: Unwanted electronic information, showing up in a digital image as lighter pixels in an otherwise dark-toned area.

nonrepro blue: Special blue marker that does not show when photographed.

opaque: (1) A condition in which no light is allowed to pass through; (2) special markers or paints that block light; (3) to block out unwanted areas on transparencies before printing.

optics: Physical study of light and how it reacts with and to other materials.

orthochromatic: Photo surfaces insensitive to orange and red light but sensitive to visible blue and green light.

panchromatic: Photo surfaces sensitive to blue and green visible light and some of the red spectrum.

photogram: A photo image produced without using a negative or camera by allowing an object to cast its shadow directly onto the recording surface.

photosensitive: The quality of reacting to light through chemical action.

pigment: Particles used to give color, body, or opacity to a semiliquid artists' material.

pixel: The smallest component of a picture that can be individually processed in an electronic imaging system. The smaller and closer together the pixels, the clearer the image. The term pixel is short for "picture (pix) element (el)." Pixels are often called dots, as in dots per inch (dpi).

pixellization: A video effect produced by dividing an image into groups of coarse square tile shapes, which display the averaged value of the picture elements they contain. See *pixel.*

positive: Photo surface containing an image in which the dark and light values correspond to the original subject.

posterization: Separate black-and-white negatives, each of which records either the highlights, the middle tones, or the shadows of the same image. In printing, usually each negative is used with a different color.

press type, press tape, press graphics: Materials with adhesive backings that will stick to other surfaces when pressed down. They can be used in making transparencies. Also known as "pressure-sensitive graphics."

print frame or **contact printing frame:** A shallow unit, usually made of wooden edge, glass plate, and backing, for holding negatives in strict contact with the emulsion during an exposure. In practice, light shines through the top glass, through the negative, and onto the photo emulsion.

print washer or **syphon:** Equipment for the flow of clean water and the elimination of dirty water.

profile: International Color Consortium (ICC) profiles are descriptions of a specific output device used by image software to match colors from one input or output device to another.

rag paper: Made from the degeneration of linen and cotton, as opposed to wood pulp.

reflective or **reflection copy:** Artwork, such as a photograph or painting, that must be viewed with light that bounces off the surface, rather than projected through the surface, such as with transparencies.

register: Fitting two or more images in exact alignment with each other, or repeating the same image on top of itself.

resampling: Also known as interpolation, or altering the image file to augment or reduce the number of pixels. When a file is permanently reduced in size, data are lost; if a file is increased in size, arbitrary data are added.

reversal: The basis of most photography, which is the conversion of a negative to a positive (or a positive to a negative).

right reading: See *correct reading.*

rubylith: A red adhesive paper, acetate marker pen, or tape used to opaque or block out portions of an image during exposure. Different manufacturers have different names for the same kind of product.

safelight: A special darkroom lamp used for illumination that does not harm the sensitized materials. Image density resulting from too much exposure to a safelight is called *fog*.

saturated solution: A liquid and chemical mixture so concentrated that no more of the chemical can be dissolved in it.

shadow: The darkest parts of a positive; the clearest parts of a film negative. Low-key areas in a computer image.

sizing: Treatment of paper that gives it resistance to the penetration of liquids or vapors.

software: Programmed instructions that tell computer hardware equipment what textual, graphic, or other informational functions to perform.

stat camera, graphic arts camera, copy camera, or **process camera:** The instrument with which photographic transparencies can be made, consisting, at least, of a light-tight area for holding film, a lens to direct and focus the image, a place to put copy or original artwork, and a light source. Although there are differences between stat cameras and copy cameras, the terms are commonly used interchangeably.

stock solution: Main concentrate of liquid chemistry from which working mixtures are made.

stop bath: A solution that halts development of emulsion, usually acetic acid.

stripping: The positioning of negatives or positives on a flat prior to exposure.

support: The surface onto which an emulsion is coated.

test strip or **test print:** A photosensitized support exposed to light and developed in a systematic way, so that bands of different exposures indicate what the finished image might look like. A guide for determining the exposure of the final picture.

thin: A transparency of overall low density, or tending to be fairly clear.

thumbnail: A collection of stored digital images that may be displayed as a series of small representations, like viewing slides on a light table or a contact sheet in photography, rather than one by one in a projector.

transparency: An image that transmits light through part of it. A transparency can be in the negative or positive, handmade or photographic, large or small (a photographic slide).

ultraviolet light: Electromagnetic radiation having a wavelength shorter than the visible portion of violet in the spectrum but longer than X-rays. Sunlight is a common source of ultraviolet light.

vacuum frame: A glass and metal device employing an air pump for holding copy and reproduction material in place during exposure.

vignetted image: Appearance of a gradual shading of an image toward the edges or periphery.

wetting agent: A liquid bath for film to help prevent dirt and water spots and to make the film attract less dust. It usually is the last bath the film touches in the development procedure.

white light: The visible spectrum of light, whether artificial or natural.

wrong reading: Facing the opposite direction from the original.

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